

Bally/Midway's
MCR II
System Games

Standardized General
Instructions

Bally

MIDWAY MFG. CO.

10750 W. Grand Avenue
Franklin Park, Illinois 60131
U.S.A.



Phone: (312) 451-1360

Cable Address: MIDCO

Telex No.: 72-1596

FORM NO. M051-00986-A025

WARNING

**THIS GAME MUST BE GROUNDED. FAILURE TO DO SO MAY
RESULT IN DESTRUCTION TO ELECTRONIC COMPONENTS.**

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a CLASS A computing device pursuant to SUBPART J of PART 15 of FCC RULES, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

ELECTRICAL BULLETIN: FOR ALL APPARATUS COVERED BY THE CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD C22.2 NO. 1, WHICH EMPLOYS A SUPPLY CORD TERMINATED WITH A POLARIZED 2-PRONG ATTACHMENT PLUG.

CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT USE THIS (POLARIZED) PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR PREVENIR CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

***Bally*/MIDWAY**
T.M.

Invites You To Use

**OUR TOLL FREE NUMBERS FOR
SERVICE INFORMATION CONCERNING THIS GAME, OR ANY
OTHER BALLY/MIDWAY™ GAME YOU NOW HAVE ON LOCATION.**

**CALL US FOR PROMPT, COURTEOUS
ANSWERS TO YOUR PROBLEMS.**

**Continental U.S. 800-323-7182
Illinois Only 1-800-942-0497**

© COPYRIGHT MCMLXXXIII BY BALLY/MIDWAY CO. ALL RIGHTS RESERVED.

NO PART OF THIS PUBLICATION MAY BE REPRODUCED BY ANY MECHANICAL, PHOTOGRAPHIC, OR ELECTRONIC PROCESS, OR IN THE FORM OF A PHONOGRAPHIC RECORDING, NOR MAY IT BE TRANSMITTED, OR OTHERWISE COPIED FOR PUBLIC OR PRIVATE USE, WITHOUT PERMISSION FROM THE PUBLISHER. THIS MANUAL IS FOR SERVICE USE ONLY, AND NOT FOR GENERAL DISTRIBUTION. FOR PERMISSION REQUESTS, WRITE: MIDWAY MFG. CO., 10750 W. GRAND AVE., FRANKLIN PARK, IL 60131

Printed in U.S.A.

TABLE OF CONTENTS

DESCRIPTION	PAGE
I. Location and Setup	1-1
Inspection	1-1
Installation	1-1
Self-Test	1-4
Game Volume Adjustment Control	1-4
Option Settings	1-4
II. Self-Test Mode	2-1
III. Maintenance and Repair	3-1
Cleaning	3-1
Fuse Replacement	3-1
Opening the Control Panel	3-2
Removal of the Main Display Glass & T.V. Bezel	3-4
T.V. Monitor Replacement	3-5
Printed Circuit Board Replacement	3-8
Opening the Attraction Panel	3-10
Servicing the Control Panel Black Light (Upright)	3-12
IV. Technical Troubleshooting	4-1
Introduction	4-1
General Suggestions	4-1
Harness Component Troubleshooting	4-1
Transformer and Line Voltage Problems	4-2
A Glossary of Microprocessor Terms	4-3
Introduction to the Z80 CPU	4-3
General Purpose Registers	4-4
Arithmetic and Logic Unit (ALU)	4-4
Introduction Register and CPU Control	4-4
Z80 CPU Pin Description	4-4
MCR II System P.C. Board Jumper Options	4-7
V. Coin Door Maintenance	5-1
Metal Coin Acceptor Mechanisms	5-1
Plastic Coin Acceptor Mechanisms	5-3
VI. T.V. Monitor Manual	6-1
Introduction	6-1
Symptom Diagnosis	6-2
Guide to Schematic Symbols	6-3
Troubleshooting	6-5
Theory of Operation	6-6
Differences Between Monitors	6-8
Controls You May Not Touch	6-9
Parts Interchangeability	6-9
Picture Tube Interchangeability	6-10
Wells Gardner Monitor Schematic — 19"	6-12
Wells Gardner Monitor Replacement Parts List	6-13
Electrohome Monitor Schematic — 19"	6-14
Electrohome Monitor Replacement Parts List	6-15
Electrohome Monitor Schematic — 13"	6-16
Electrohome Monitor Replacement Parts List	6-17
Zenith Monitor — Sweep Board Schematic	6-18
Zenith Monitor — Sweep Board Replacement Parts List	6-19
Zenith Monitor Main Board Schematic	6-20
Zenith Monitor Main Board Replacement Parts List	6-21
Zenith Monitor — CRT Socket Board Replacement Parts List	6-22
Zenith Monitor — CRT Socket Board Schematic	6-23
Zenith Monitor Width Step Assy. Schematic	6-24
Zenith Monitor Interconnect for Video Game Schematic	6-25

TABLE OF FIGURES

FIGURE	PAGE
1-1 Location of Serial No., Interlock Switch, On/Off Switch, and Major Sub-Assemblies	1-2
1-2 Major Sub-Assemblies (Cont. from Fig. 1-1)	1-3
1-3 Interlock Switch Operation	1-3
1-4 Location of Volume Control	1-4
1-5 Location of Option Switches	1-4
1-6 Option Switch Settings	1-5
2-1 Self-Test — Menu	2-1
2-1a Self-Test — Sounds	2-2
2-1b Self-Test — Player Inputs	2-2
2-1c Self-Test — Bookkeeping	2-2
2-1d Self-Test — Time Report	2-2
2-1e Self-Test — Score Report	2-3
2-1f Self-Test — Set-Up Options	2-3
2-1g Self-Test — Channel Test	2-3
2-2 Location of Hardware Master Reset Switch	2-4
3-1 Location of Fuses	3-1
3-2 Opening the Control Panel — Upright & Mini	3-2
3-3 Opening the Cocktail Game	3-3
3-4 Removing the Control Panel — Cocktail	3-3
3-5 Removing the Main Display Glass & T.V. Bezel — Upright	3-4
3-6 Removing the Main Display Glass & T.V. Bezel — Mini	3-4
3-7 Removing the Top Glass & T.V. Bezel — Mini	3-5
3-8 Removing the Monitor — Upright	3-6
3-9 Removing the Monitor — Mini	3-6
3-10 Opening the Cocktail Game	3-7
3-11 Removing the Monitor — Cocktail	3-7
3-12 Removing P.C.B.'s	3-8
3-13 Removing P.C.B.'s from Card Rack	3-9
3-14 Opening the Attraction Panel — Upright	3-10
3-15 Replacing Fluorescent Light Fixture	3-11
3-16 Opening the Attraction Panel — Mini	3-11
3-17 Servicing Control Panel Black Light — Upright	3-12
3-18 Removing Black Light Tube Mtg. Brkt. — Upright	3-12
5-1 Removing and Replacing the Coin Acceptor	5-1
5-2 Cleaning the Metal Coin Acceptor	5-2
5-3 Lubricating the Metal Coin Acceptor	5-2
5-4 Opening the Plastic Coin Acceptor	5-3
5-5 Changing the Plastic Coin Acceptor to Accept American or Canadian Quarters	5-4

I. Location and Setup

INSPECTION:

1. Remove the game from its shipping crate.
2. Inspect the entire outside of it for any signs of damage.
 - ☐ Any scratches?, dents?, cracks?
 - ☐ Any broken controls?
 - ☐ Any broken glass or plastic?
 - ☐ Just look it over closely and make a note of any signs of damage.
3. Remove the shipping cleats from the bottom of the cabinet.
4. Install the four levelers, one at each corner of the cabinet.
 - ☐ Level the cabinet.
5. Open the cabinet and inspect the inside of the game for any signs of damage. See Figure 1-1.
 - ☐ Also check to make sure all plug-in connectors on the wire harness are firmly seated.

NOTE: ALL connectors or plugs are keyed so they will only go together when all pins are properly lined up.

- ☐ Replug any connectors found unplugged. **DO NOT FORCE PLUGS ONTO CONNECTORS. DO NOT FORCE PLUGS TOGETHER.** If it won't go on easily, assuming the keys are lined up, it either does not belong there or is damaged.
 - ☐ Make sure all printed circuit boards (P.C.B.'s) are firmly seated in their connectors. These connectors are also keyed. The P.C.B.'s will only go into them one way without being damaged.
 - ☐ Note the location of the game's serial number. See Figure 1-1.
 - ☐ Check all major subassemblies to be sure they are mounted securely. These are called out in Figures 1-1 & 1-2.
 - Power supply.
 - Control panels(s).
 - T.V. monitor.
 - Other P.C.B.'s and/or P.C.B. rack, etc.
 - Power supply chassis assembly.
6. Make a note of any problems that can't be easily corrected.
 7. Call your distributor and/or service man about your problem list.

INSTALLATION:

1. Location requirements:

- ☐ **Power:**
 - Domestic 110 V @ 60 Hz
 - Foreign 200 V to 240 V @ 50 Hz
- ☐ **Temperature:** 32° to 100° F (0° to 38° C)
- ☐ **Humidity:** Not over 95% relative
- ☐ **Space required:**
 - Upright 25" x 32" (63 x 81cm) APPROX.
 - Mini 20" x 24" (50 x 60cm)
 - Cocktail 32" x 22" (81 x 55cm)
- ☐ **Game height:**
 - Upright 70" (175cm) APPROX.
 - Mini 61" (153cm)
 - Cocktail 29" (73cm)

2. Voltage Selection:

Your game is designed to work properly on the line voltage where you are located. Check your line voltage with a meter to determine what its value is. Then check the power input wires to the main power supply transformer on your game to be sure they are connected to taps which correspond to your line voltage value.

If the power input wires to the main power supply transformer are not connected to taps which correspond to your local line voltage, move them to the proper taps.

If the line voltage in your area falls outside the upper or lower limits of the range of inputs covered by the main power supply transformer, **DO NOT PLUG YOUR GAME IN** until you have talked with your distributor and/or service man and obtained a solution to this problem. Otherwise you could damage your game.

3. Interlock and power ON/OFF switches. See Figure 1-1.

- ☐ To help prevent the possibility of getting an electric shock while working inside the game cabinet, interlock switches have been installed at each cabinet access door (this **DOES NOT** include the coin door in the Upright and Mini models).
- ☐ When any access door is opened, the interlock switch installed there turns off all power to the game.

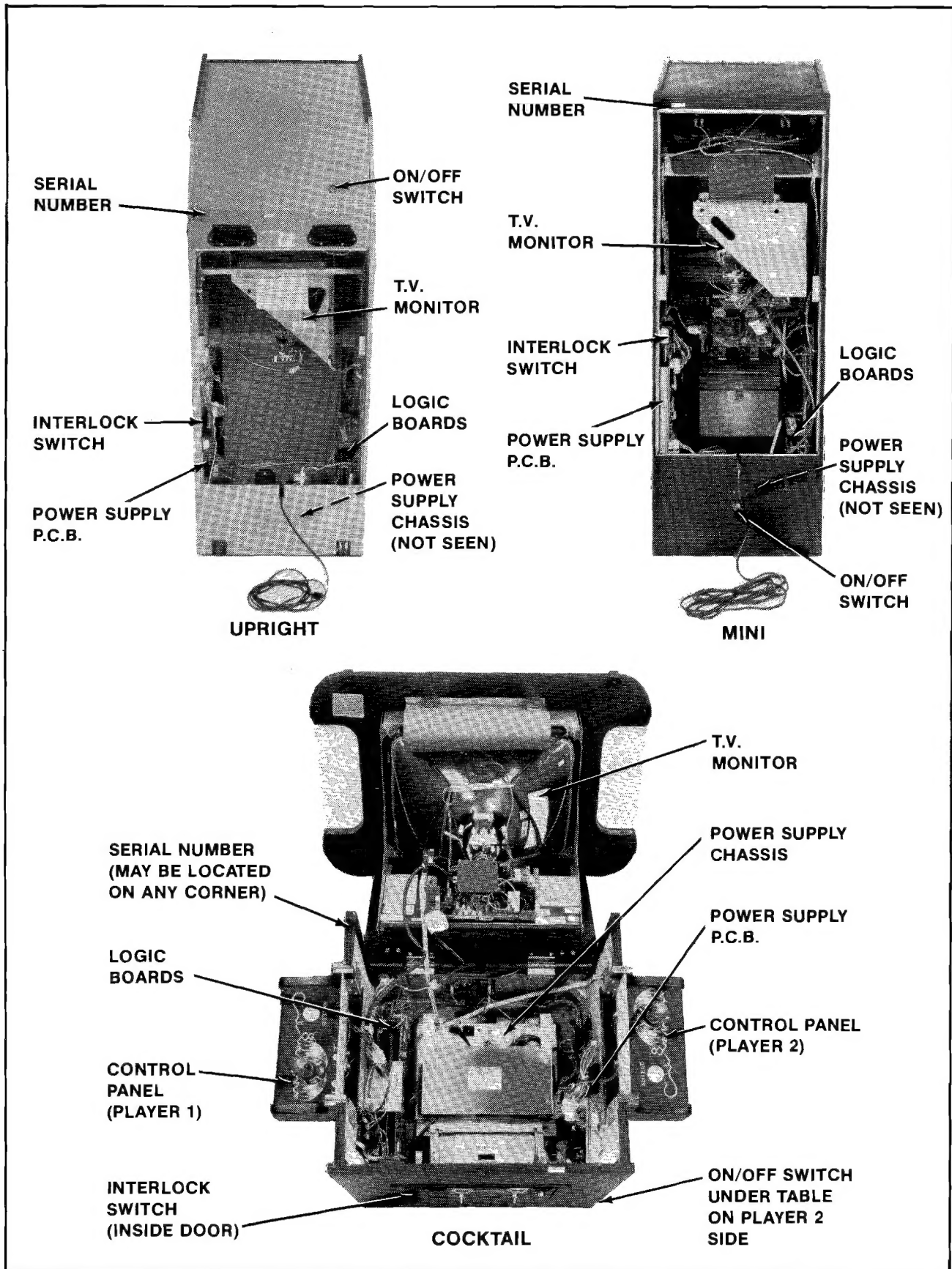


Figure 1-1 Location of Serial No., Interlock Switch, On/Off Switch, & Major Sub-Assemblies

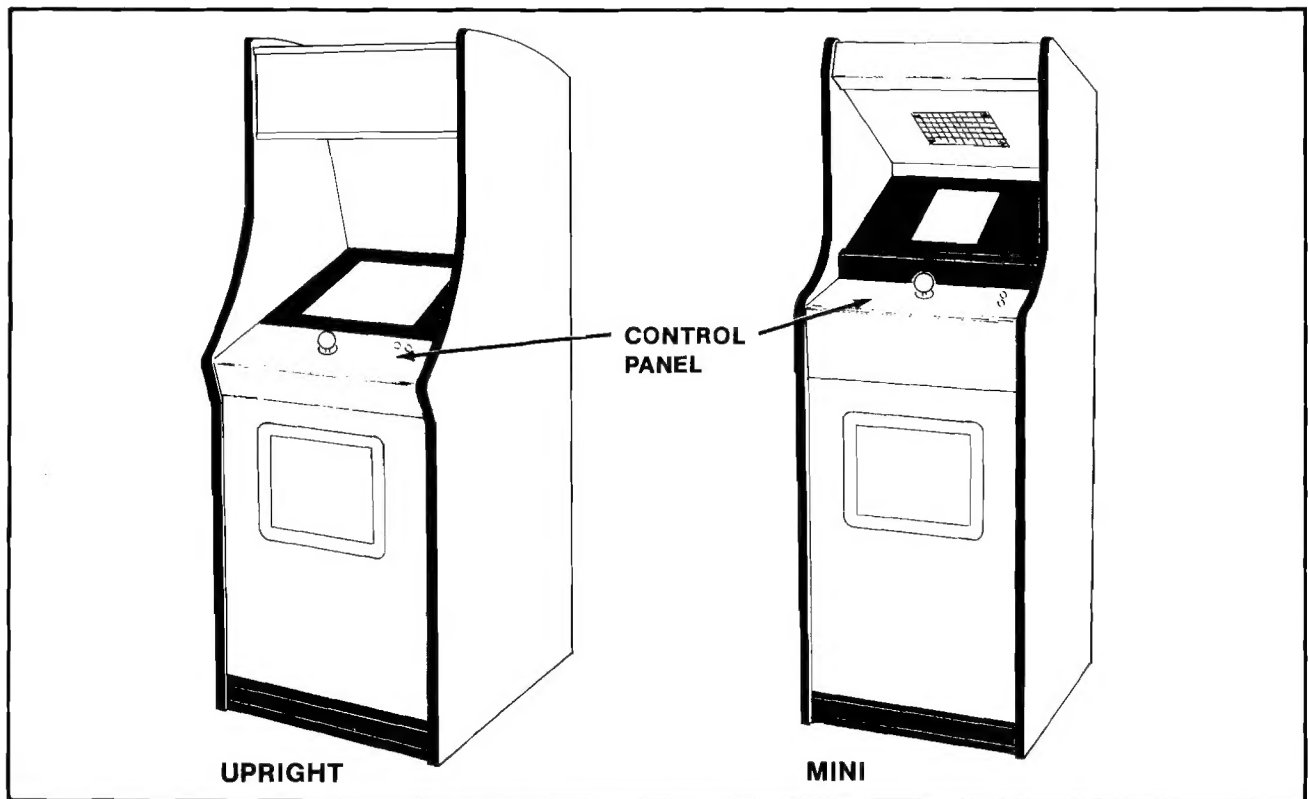


Figure 1-2 Major Sub-Assemblies (cont. from Fig. 1-1)

- Check each interlock switch for proper operation.

After checking the line voltage in your area and determining that the input wires to the main power supply transformer of your game are connected properly — or — after obtaining a solution to your over or under voltage problem from your distributor and/or your service man, plug the game into your A.C. wall outlet.

The game ON/OFF switches for all models are located as shown in Figure 1-1. Turn the game on and allow it to warm up a few minutes.

Slowly open each access door to the game (this **does not** include the coin door on the Upright and Mini models).

As the door is opened approximately 1" (2.54cm) the power to the game should go off (the T.V. monitor, all the lights, and all sounds will stop).

If this does not happen, check the interlock switch by this door to see if it has broken loose from its mounting or if it is stuck in the "ON" position.

If the switch is found to be bad, turn the game off, unplug it, and replace the interlock switch.

When done, plug the game back into the wall outlet, close the access door, and turn the game back on.

After the game has warmed up, repeat the above interlock switch test.

When the interlock switch is working properly and turns the power to the game off, power may be restored to the game with the access door(s) open. Take hold of the interlock switch plunger and **gently** pull it out to its fully extended position. **THIS IS TO BE USED ONLY FOR SERVICING THE GAME.** See Figure 1-3.

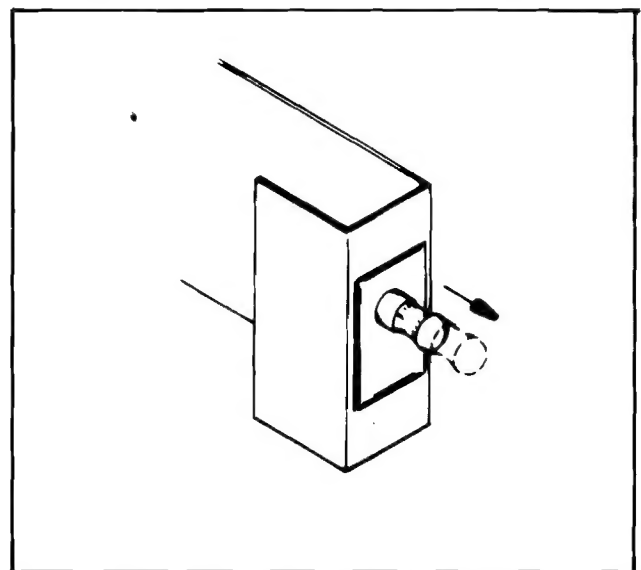


Figure 1-3 Interlock Switch Operation

SELF-TEST:

Your new game will Self-Test itself to see if it has any bad parts. The information it receives while testing itself will be shown on the T.V. monitor. See the SELF-TEST section for a more detailed description of this function.

When there is a bad result according to the Self-Test, call your distributor and/or service man to have the trouble fixed unless it is something you can do yourself (such as replace a bad RAM or ROM chip).

GAME VOLUME ADJUSTMENT CONTROL:

See Figure 1-4.

The game volume control pot is located just inside the cabinet coin door frame. There is only one pot. For adjustment, it may be reached through the coin door on **ALL** models.

To make the sounds louder, turn the pots clockwise as you face them (↻).

To make the sounds **less** loud, turn the pots counter-clockwise as you face them (↺).

OPTION SETTINGS:

To change the most common option settings, you **DO NOT** have to take the game apart or go into the cabinet and hunt for tiny switches on P.C. boards. These most common options can be changed from the main console of the game while it is in the Self-Test mode. The Self-Test switch is located just inside the cabinet coin door frame as you face it.

When changing any options, **ALWAYS** perform the Self-Test and play the game to be sure the ones selected are working properly. Of course, when you

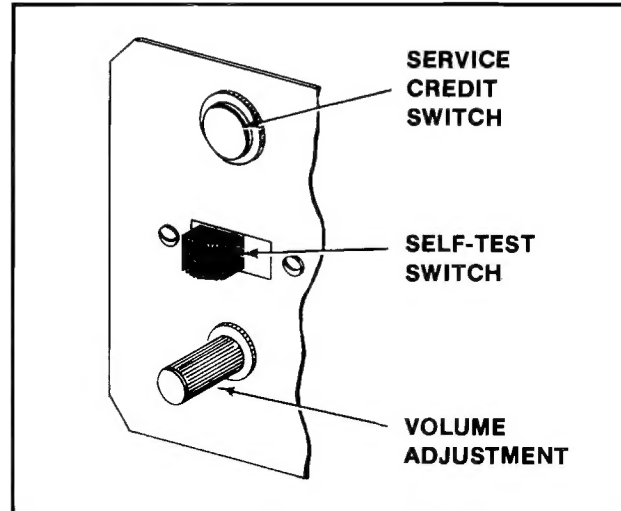


Figure 1-4 Location of Volume Control

must change one of the switches that is located on one of the game's P.C. boards, it is also recommended that you perform the Self-Test and play the game to be sure the switches have worked properly and that no switches were accidentally moved that were not meant to be. (These switches are small and this can happen.)

The P.C. Board option switch settings, and what they will make the game do are shown in Figure 1-6. These switches are **MAINLY INTENDED** for use by a technician who is checking and/or performing tests on the game. See Figure 1-5 for option switch locations.

NOTE: In order to set the option switches located on the game's P.C. Boards, these Boards need not be removed from their card rack.

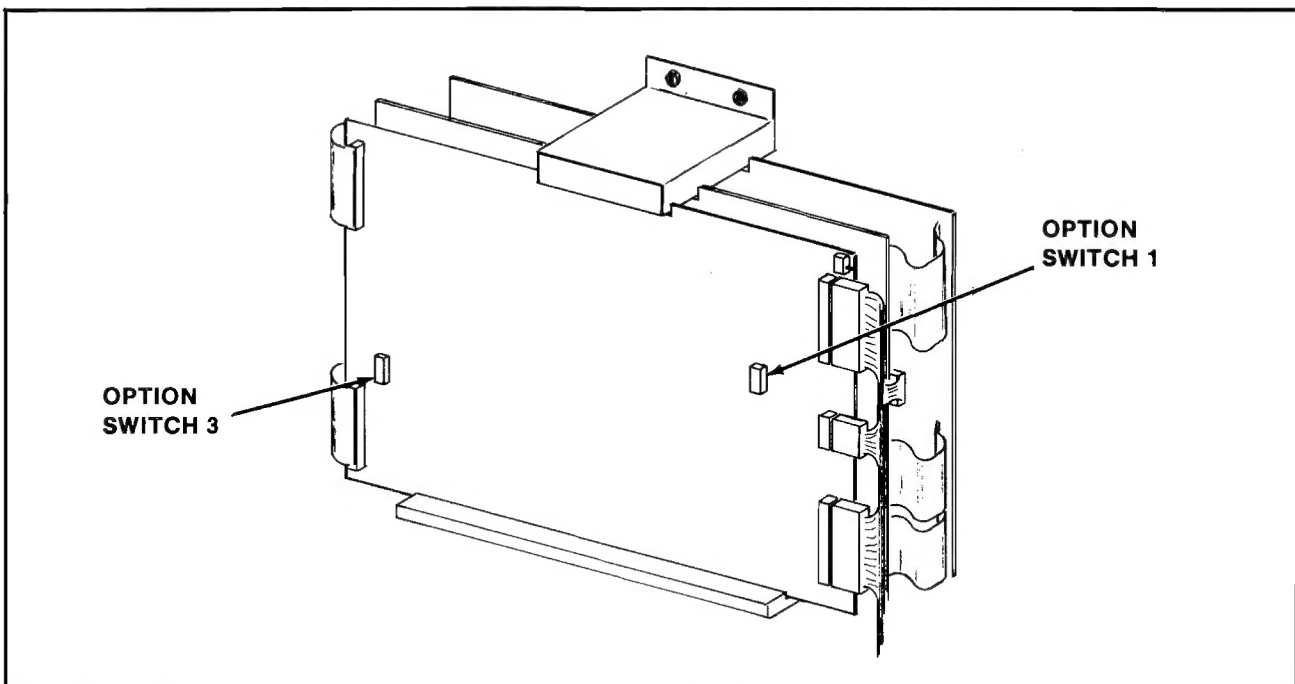


Figure 1-5 Location of Option Switches

II. Self-Test Mode

The Self-Test mode is a special mode for checking game play statistics as well as game switches and computer functions. It is the easiest and best way to check for proper operation of the entire game.

NOTE: Putting the game into Self-Test **WILL NOT** cause the game to erase any CREDITS it has in its memory when the Self-Test mode is entered.

You may begin a Self-Test at any time by sliding the Self-Test switch to the "ON" position after the power to the game is on (the Self-Test switch is located just inside the cabinet coin door frame as you face it). When this is done, the game will react as follows:

1. If the game is in the Attract mode when the Self-Test switch is moved to the "ON" position, it will finish the sequence and then go into the Self-Test mode. This is illustrated by the display of the Self-Test Mode Menue on the monitor screen.
2. If the game is in the Ready-To-Play mode or the Play mode when the Self-Test switch is slid to the "ON" position, it **WILL NOT** go into the Self-Test mode until **AFTER** the game is over. At this point, the game will go into the Self-Test mode. Again, this is illustrated by the display of the Self-Test Mode Menue on the monitor screen.
3. The fastest way to enter the Self-Test mode is to slide the Self-Test switch to the "ON" position and then activate the "TILT" switch located on the back side of the coin door just below the lock mechanism. The game will then **IMMEDIATELY** go into the Self-Test mode.

The Self-Test mode has eight (8) major categories as illustrated by Figure 2-1.

1. It is easy to select what category you want to enter. By following the ON SCREEN instructions, the Cursor at the left of the screen can be moved UP or DOWN until it is in front of the category you want to test.
2. After the Cursor has been positioned, follow the ON SCREEN instructions again, and the monitor screen will display the test category you have selected.

NOTE: There is one exception to this. If you select the "PRE-SET" category on the Self-Test Mode Menue, **EVERYTHING**, I repeat — **EVERYTHING** — including **ALL** information in the "BOOKKEEPING" mode, and **ALL** operator selected options, will be set back to zero ("0") and to the factory recommended settings — **respectively**.

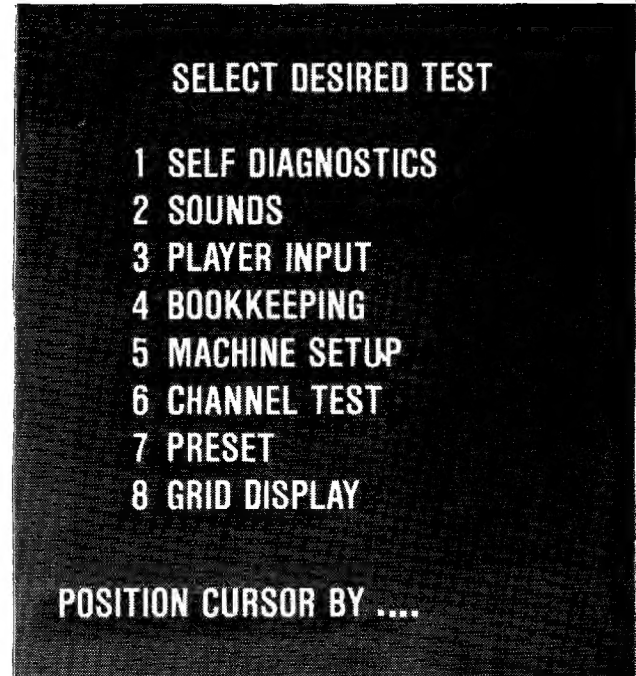


Figure 2-1 Self-Test — Menue

□ Once you are **IN** one of the Self-Test mode categories, FOLLOW THE **ON-SCREEN** INSTRUCTIONS TO **COMPLETE** THE TEST.

3. The next group of Figures show the **CORRECT** screen presentation for **EACH** category of the Self-Test mode.

During the SELF DIAGNOSTICS section of the Self-Test mode, you will **first** see a cross hatch pattern on the screen for about 1/2 second. **Second**, you will see a lot of different colored bars shown on the monitor screen. These bars will be UNpainted one at a time from the top down. **Third**, you will see the screen painted Red, Blue, and Green in bars from the top down. **Fourth**, all the different colored bars you saw "**Second**" are displayed again. And **fifth**, the different colored bars are replaced by an exit message. If you do not exit, the test will repeat itself. This feature was designed into the game to enable over-night testing for an intermittent hardware problem.

If the SELF DIAGNOSTICS find one or more bad ROM or RAM chips: instead of going through what is described above, the game will give you a written message as to which parts are bad. This message includes their I.D.'s and their P.C. Board locations.

During the SOUNDS section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1a.

- In this category, each of the game's separate sounds can be checked individually in any order — or — you can tell the game to check them all in order.

During the PLAYER INPUT section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1b.

- In this category, each of the game's player operated controls — including the coin switches on the back side of the coin door — may be checked individually. A game sound will be heard as each switch/control is actuated. If no game

sound is heard, that switch/control is either not working, miswired, or disconnected. Check it out thoroughly.

During the BOOKKEEPING section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1c.

- In this category a basic bookkeeping function is performed. And with the selection of the "TIME REPORT" and the "SCORE REPORT", detailed breakdowns of game times and scores may be obtained.

In the TIME REPORT and SCORE REPORT sections of the BOOKKEEPING mode, the game will give displays which look like those shown in Figures 2-1d and 2-1e respectively.

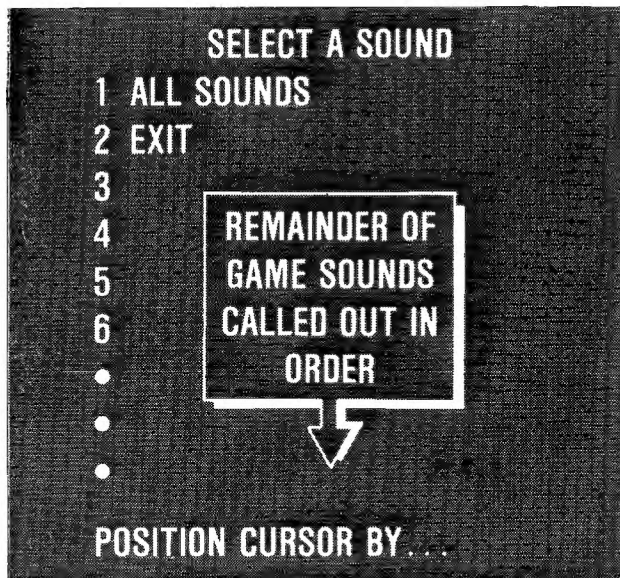


Figure 2-1a Self-Test — Sounds

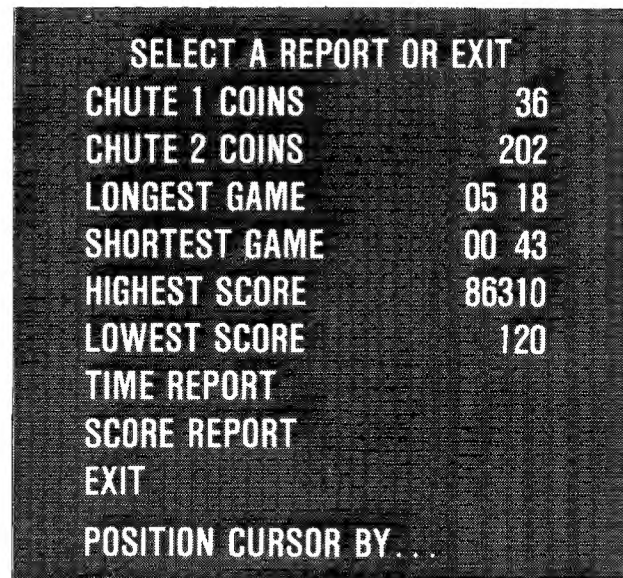


Figure 2-1c Self-Test — Bookkeeping

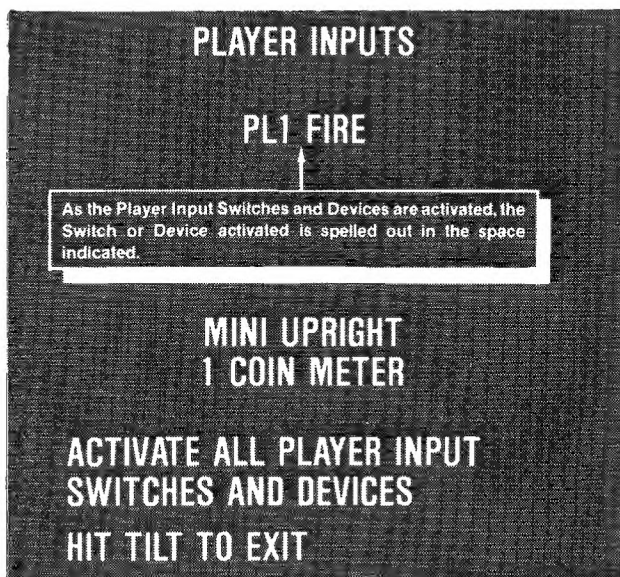


Figure 2-1b Self-Test — Player Inputs

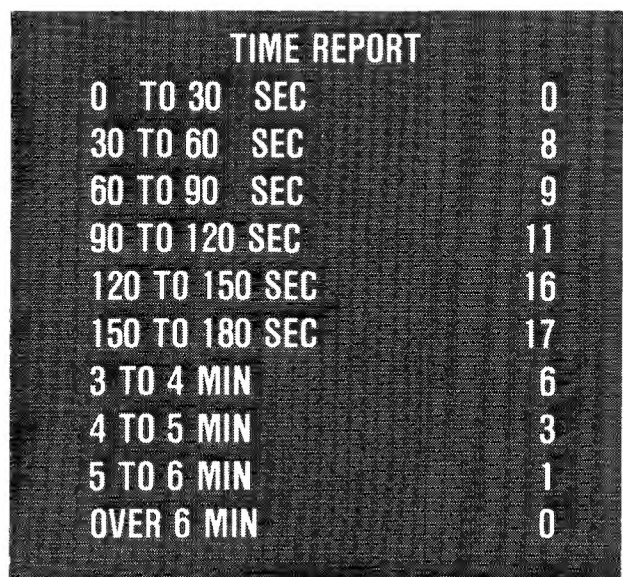


Figure 2-1d Self-Test — Time Report

SCORE REPORT	
0 TO 5000 PTS	14
5000 TO 10000 PTS	13
10000 TO 20000 PTS	24
20000 TO 40000 PTS	16
40000 TO 70000 PTS	3
70000 TO 100000 PTS	1
100000 TO 150000 PTS	0
150000 TO 200000 PTS	0
200000 TO 250000 PTS	0
OVER 250000 PTS	0

Figure 2-1e Self-Test — Score Report

During the SETUP OPTIONS section of the Self-Test mode, the game will give a display which looks similar to that shown in Figure 2-1f.

- ☐ In this category, all common game options may be changed from the control console: coins per credit, credits per base, bonus base(s) awarded at, difficulty level - -, and so on.

SETUP OPTIONS	
COIN CHUTE 1	
*1 COINS FOR	
*1 CREDITS	
COIN CHUTE 2	
*1 COINS FOR	
*1 CREDITS	
*1 CREDITS FOR	
*3 BASES	
1ST EXTRA BASE AT	
*20000 POINTS	
ADDITIONAL BASE EVERY	
*20000 POINTS	
*3 DIFFICULTY LEVEL	

* = Factory recommended settings.

Figure 2-1f Self-Test — Set-Up Options

DIFFICULTY LEVEL EXPLANATION:

The Difficulty Level setting has a range of 1 to 9. With 1 being the easiest level of play and 9 being the most difficult level of play. We recommend that a setting of 3 be used as a beginning point.

Game play can then be made **MORE** difficult or **LESS** difficult, according to the skill levels attained by the players in your area.

CHANNEL TEST:

During the CHANNEL TEST section of the Self-Test mode, the game will give a display which looks like that shown in Figure 2-1g.

- ☐ In this category, the game conducts a test of its SOUND SYSTEM.

Once you enter the CHANNEL TEST section of the Self-Test mode, the game automatically tests Channels 1 through 6 giving a tone for each one as it checks it. After the 6th Channel is tested, the game automatically repeats the test until exited. It then goes back to the Self-Test Mode Menu.

During the GRID DISPLAY section of the Self-Test mode, the game shows a white cross hatch pattern on the monitor screen. This is for alignment and/or test purposes. This pattern will remain on the monitor screen until exited. The game will then go back to the Self-Test Mode Menu.

To leave the Self-Test mode, simply slide the Self-Test switch to the "OFF" position at **ANY** time. The game will then run through the ROM/RAM test display after which normal game functions will return to the monitor screen.

CHANNEL TEST	
CHANNEL 1	
CHANNEL 2	
CHANNEL 3	
CHANNEL 4	
CHANNEL 5	
CHANNEL 6	

Figure 2-1g Self-Test — Channel Test

RACK ADVANCE:

The game can be made to advance through the various racks by beginning a game **and THEN** sliding the Self-Test switch to the "ON" position. After this has been done, each time you depress the ONE PLAYER BUTTON the game will advance one rack.

When you reach the desired rack, slide the Self-Test switch to the "OFF" position. (If you leave the Self-Test switch in the "ON" position, the game will go into the Self-Test mode when you are finished playing.)

CROSS HATCH PATTERN:

A cross hatch pattern is shown on the screen when power is first turned on to the game, when the TILT Switch is actuated, and during the "SELF DIAGNOSTIC" portion of the Self-Test mode, and during the "GRID DISPLAY" portion of the Self-Test mode.

This pattern may be kept on the screen for adjustment purposes as described earlier.

When you are finished using the cross hatch pattern, simply exit at the GRID DISPLAY to return to the Self-Test Mode Menu.

HARDWARE MASTER RESET SWITCH:

There are two of these little red switches, one on the Sound I/O Board and one on the CPU Board, located as shown in Figure 2-2.

The function of each of these switches — when pressed — is to make the game think it has **JUST** been turned on. They set up an "initial power-up" condition.

We **DO NOT** recommend that you indiscriminately press **EITHER** of these switches. They should **ONLY** be used if there is a major problem encountered while testing the P.C. Boards.

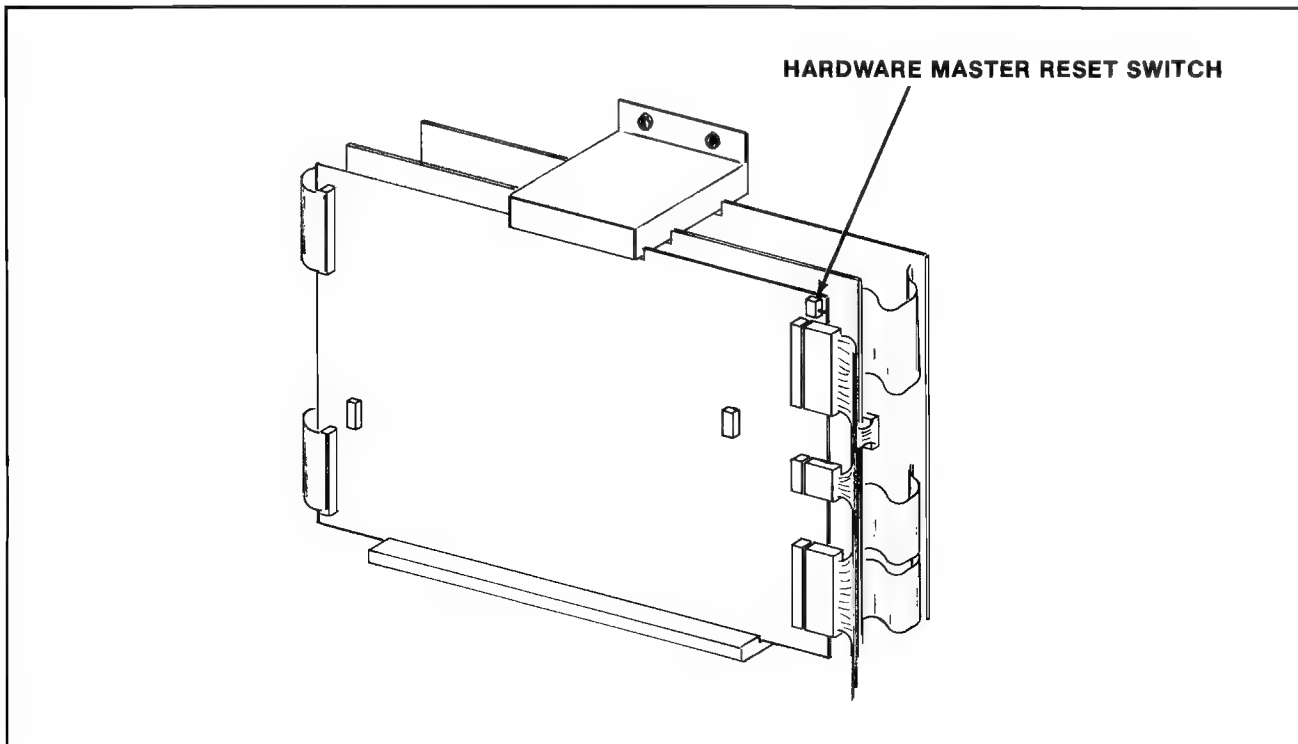


Figure 2-2 Location of Hardware Master Reset Switch

III. Maintenance and Repair

Your **NEW** game needs certain types of maintenance to keep it in good working order. **CLEAN**, well **MAINTAINED** games **attract players** and **EARN MORE PROFITS**.

The most important thing for you to remember is to run the Self-Test **EVERY TIME** you collect money from the coin box. **JUST LOOKING** at your game **WILL NOT** tell you if all its controls and inside parts are working correctly. The Self-Test will inform you whether or not your game is working the way it should.

The second most important thing you should remember is to clean the outside of the game and coin acceptor mechanisms on a regular basis.

CLEANING

The outside of the game cabinet plus the metal can be cleaned with any non-abrasive household cleaner. However, the front of the T.V. monitor tube and **both sides** of all other glass and plastic on or in the game **MUST** be cleaned with anti-static cleaner **ONLY**. For cleaning the coin acceptors: hot soapy water may be used on the plastic ones and any household cleanser may be used on the metal ones. If you wish, special coin machine cleaners that leave no residue may be purchased from your distributor.

DO NOT dry-wipe any of the plastic panels. This is because any dust that was on them can scratch their surfaces. If this has happened, anyone looking through this type of damaged plastic would feel he was looking at the game through a fog. This fogging

damage **CANNOT** be repaired or reversed. The **ONLY** solution is to **replace** the damaged piece of plastic.

FUSE REPLACEMENT

This game contains several fuses located as shown in Figure 3-1.

1. UPRIGHT MODEL:

As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Power Supply Chassis and Power Supply P.C. Board.

2. MINI MODEL:

As viewed from the back, facing the cabinet, with the rear access door removed; the fuses are located on the Power Supply Chassis and Power Supply P.C. Board.

3. COCKTAIL TABLE MODEL:

As viewed from the coin door side of the cabinet, with the monitor tilted open to one side; the fuses are located on the Power Supply Chassis and the Power Supply P.C. Board.

Replace fuses **ONLY** with the type and size listed in the Illustrated Parts Breakdown Section of your game manual.

See the T.V. Monitor Manual (available on request from your distributor or the monitor manufacturer) and/or the T.V. Troubleshooting Section of your game manual for information on these fuses.

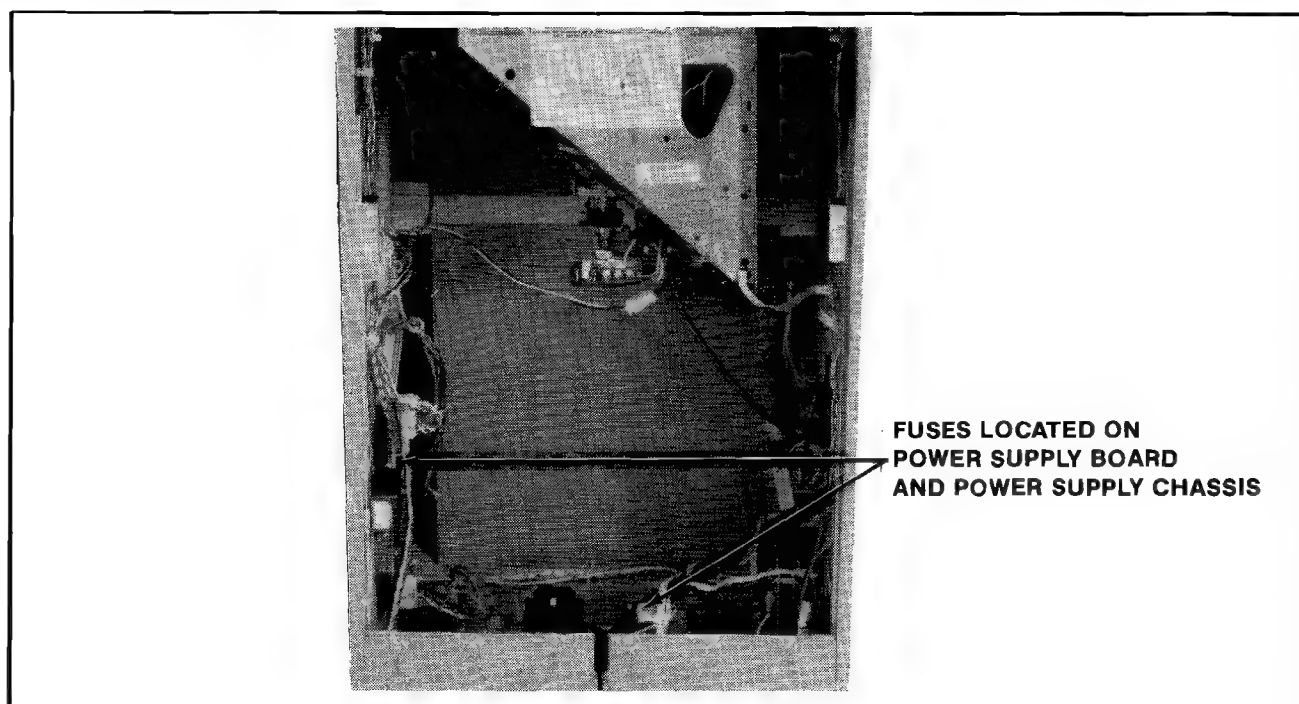


Figure 3-1 Location of Fuses

OPENING THE CONTROL PANEL

1. UPRIGHT MODEL: See Figure 3-2.

- The control panel is held in place by two or three latches, one on the left side and one on the right side of the cabinet.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door **AFTER turning power to the game off.**

To release the latches, lift up and toward the front center of the control panel.

Once they are released, unhook them from their latch plates.

- To remove the control panel:

Raise it up and tilt it toward you until you can see the cable behind it.

Cradling the control panel between yourself and the cabinet, disconnect it from its cabling and nylon retaining strap.

The control panel is now free and can be removed.

- To reinstall the control panel, reverse this procedure.

2. MINI MODEL: See Figure 3-2.

- The control panel is held in place by two latches, one on the right side, and one on the left side of the cabinet.

They are spring loaded to provide constant positive pressure on their latch plates.

They can be reached through the coin door **AFTER turning power to the game off.**

To release the latches, lift up and toward the center of the control panel.

Once they are released, unhook them from their latch plates.

- To remove the control panel:

Raise it up and tilt it toward you until you can see the cable behind it.

Cradling the control panel between yourself and the cabinet, disconnect it from its cabling and nylon retaining strap.

The control panel is now free and can be removed.

- To reinstall the control panel, reverse this procedure.

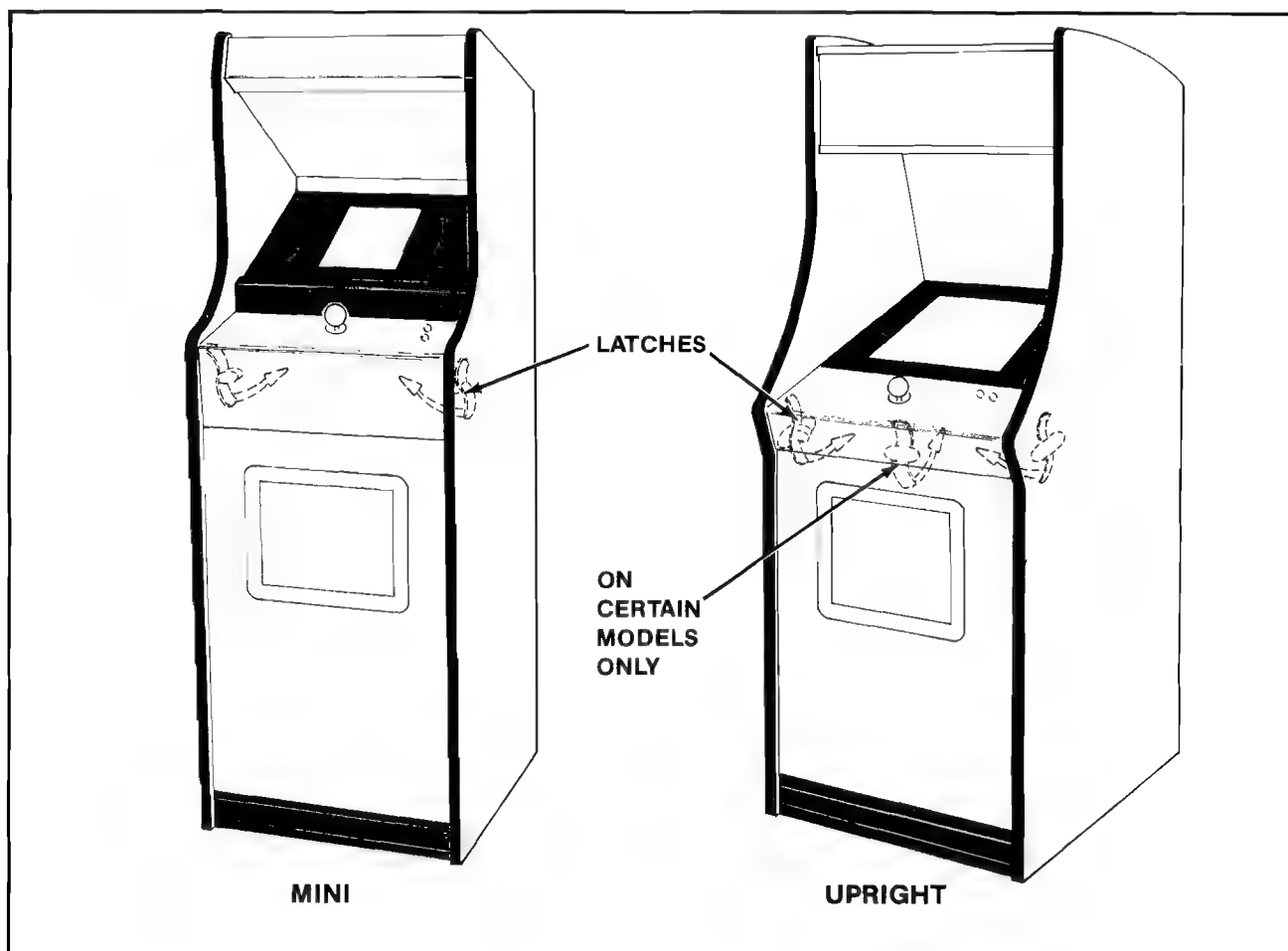


Figure 3-2 Opening the Control Panel — Upright & Mini

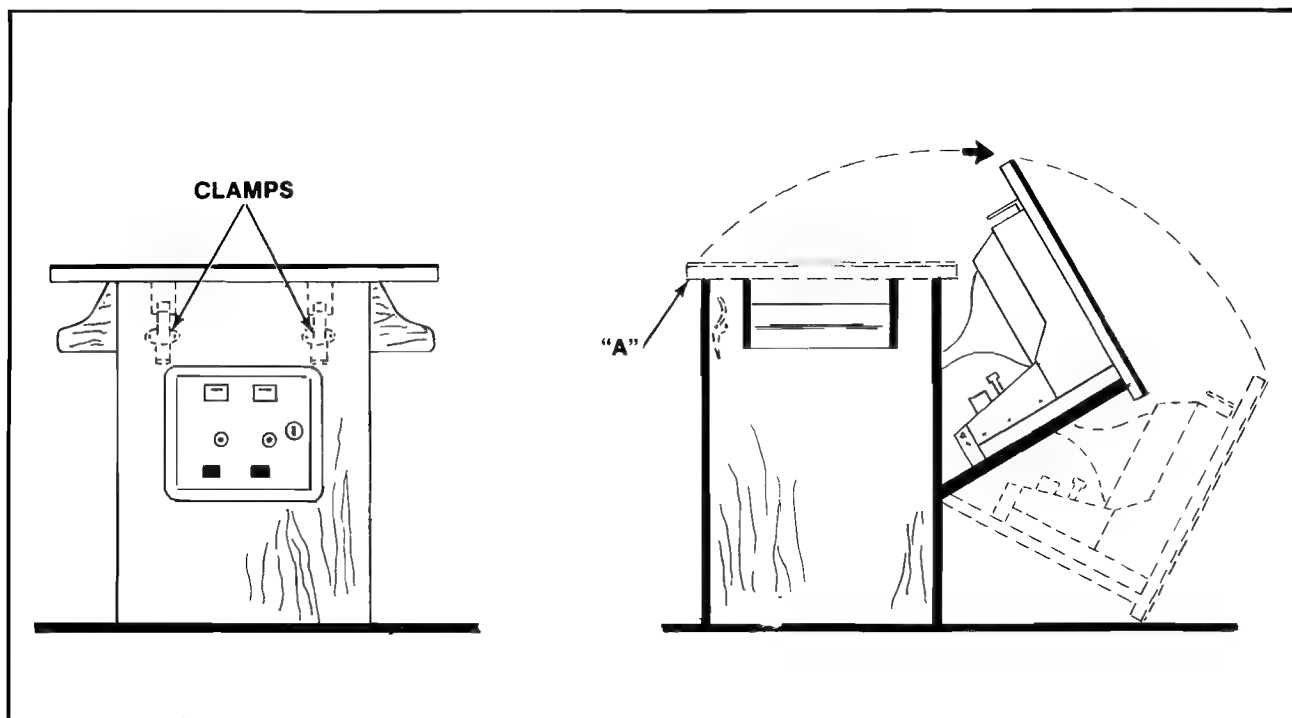


Figure 3-3 Opening the Cocktail Game

3. COCKTAIL TABLE MODEL: See Figure 3-4.

- Each control panel is held in place by several screws, two on the inside of the cabinet and three along the outside bottom edge of the control panel.

Turn power to the game off.

Open the coin box door and release the two latches indicated in Figure 3-3.

CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor. BE CAREFUL!!

Once they're released, unhook them from their latch plates.

Grasp the table top at "A" and open it as indicated in Figure 3-3.

CAUTION: Due to the weight of the monitor, EXTREME CARE MUST be taken when opening the cabinet.

Remove the screws which secure the control panel in place. See Figure 3-4.

- To remove the control panel(s):
Disconnect it from its cabling.
The control panel is now free and can be removed.
- To reinstall the control panel, reverse this procedure.

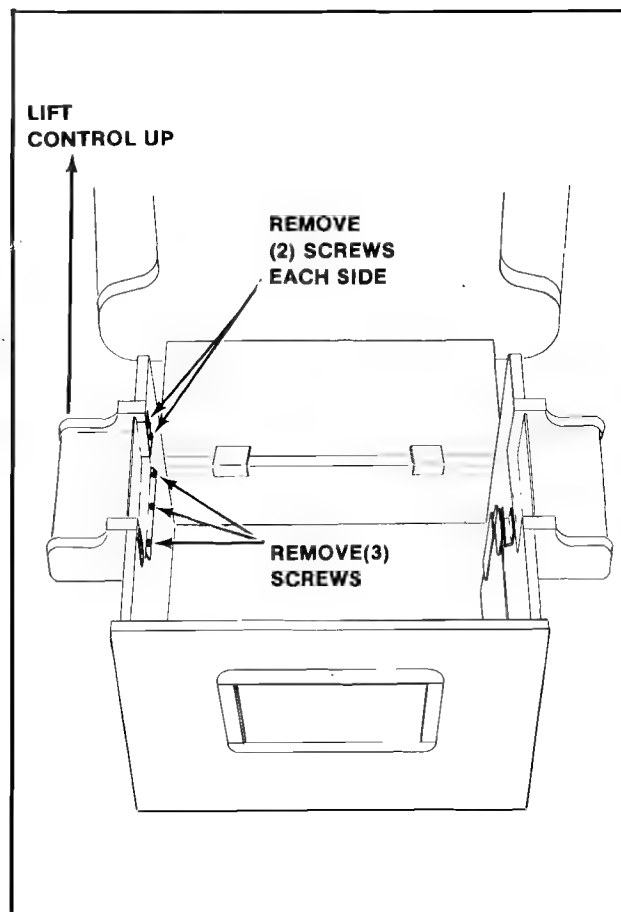


Figure 3-4 Removing the Control Panel — Cocktail

REMOVAL OF THE MAIN-DISPLAY-GLASS AND/OR THE T.V. BEZEL ASSEMBLY

1. UPRIGHT MODEL: See Figure 3-5.

NOTE: In order to do this, the control panel **MUST** be removed first. See the "Upright Model" procedure.

- ☐ **Turn the power to the game off** and remove the control panel. This gets the control panel stick out of the way so the main-display-glass can be removed.
- ☐ Remove the screws securing the main-display-glass retainer and the main-display-glass in place as shown in Figure 3-5 and lift out the main-display-glass. (Certain models only.)
- ☐ Remove the screws which secure the T.V. bezel assembly in place.
- ☐ The T.V. bezel assembly is now free and can be slid out of the cabinet.
- ☐ To reinstall the T.V. bezel assembly and the main-display-glass, reverse this procedure.

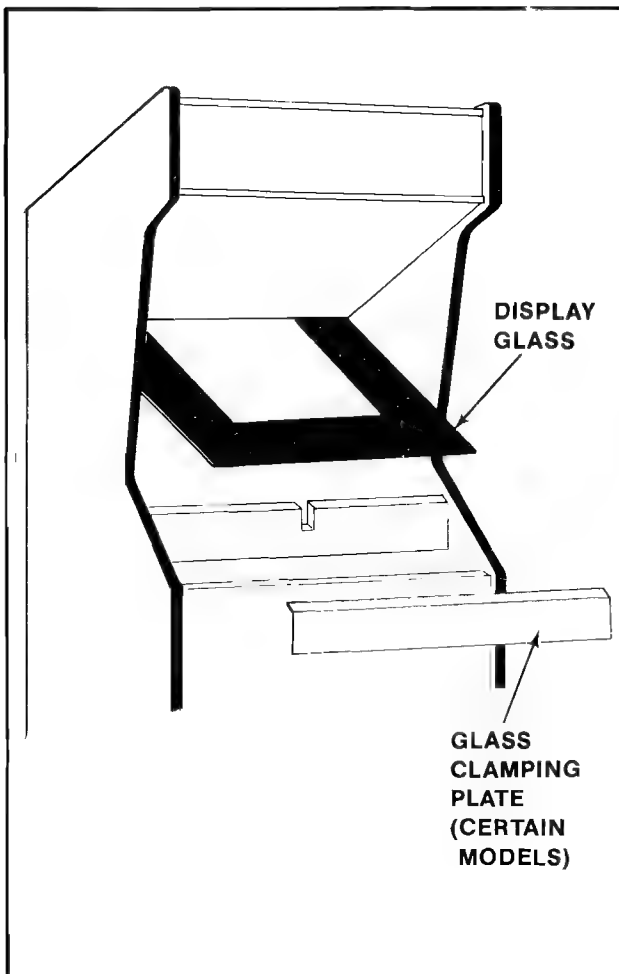


Figure 3-5 Removing the Main Display Glass & T.V. Bezel — Upright

2. MINI MODEL: See Figure 3-6.

NOTE: In order to do this, the control panel **MUST** be removed first. See above "Mini Model" procedure.

- ☐ **Turn the power off to the game** and remove the control panel.
- ☐ Remove the screws which secure the glass clamping plate. See Figure 3-6.
- ☐ Lift out the glass clamping plate. This frees the main-display-glass so it can be lifted up.
- ☐ By putting your finger in the hole in the middle of the main-display-glass support, you can lift it up and out.
- ☐ Remove the screws which secure the T.V. bezel assembly and lift it out.

NOTE: Use the hole in the center of the main-display-glass support to grasp it.

- ☐ Reverse this procedure to reinstall the T.V. bezel assembly and the main-display-glass.

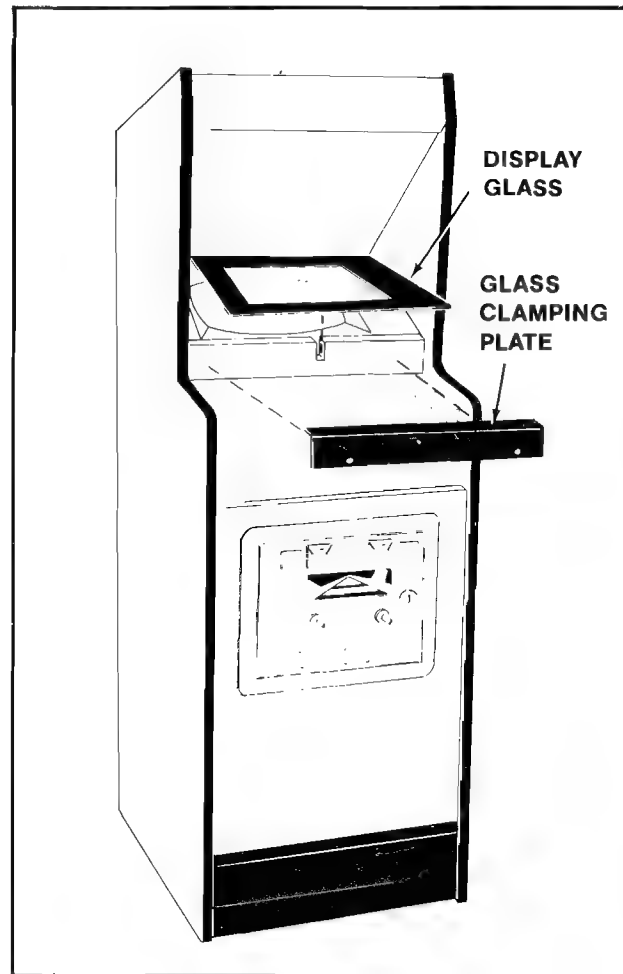


Figure 3-6 Removing the Main Display Glass & T.V. Bezel — Mini

3. COCKTAIL TABLE MODEL: See Figure 3-7.

NOTE: This may be done with the table top in the closed or the open position. If you decide to open the table top, **TURN THE POWER TO THE GAME OFF FIRST.**

- ☐ Remove the screws which secure the table top glass clamps in place.
- ☐ Remove the table top glass.
- ☐ Loosen the screws which secure the T.V. bezel-glass-clamps in place.
Move the clamps to the side and the bezel glass may be removed.
Remove the screws which secure the bezel assembly to the table top and the bezel with four bezel-glass-clamps may be removed.
- ☐ To reinstall the T.V. bezel assembly and the table top glass, reverse this procedure.

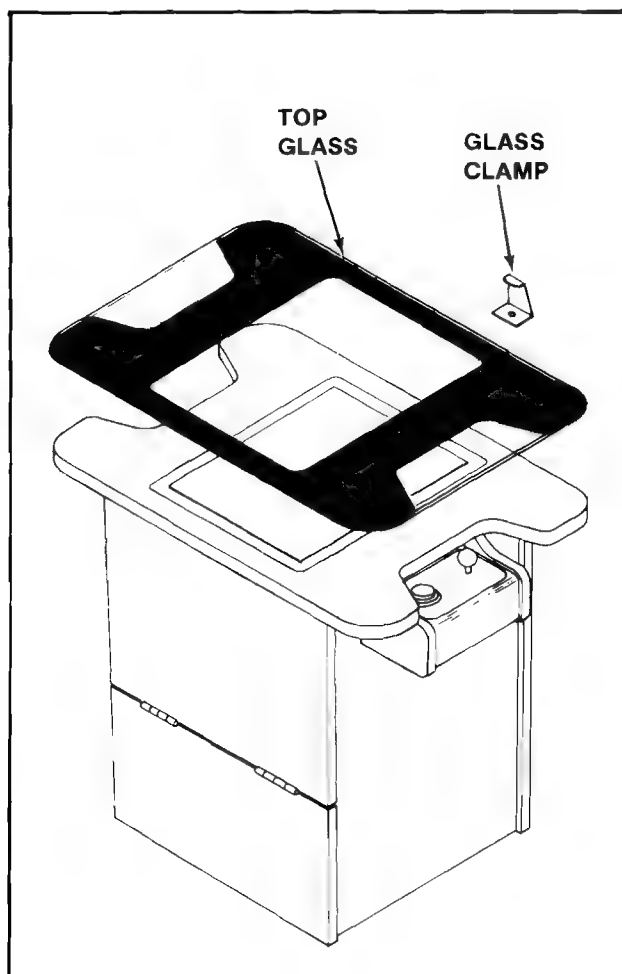


Figure 3-7 Removing the Top Glass & T.V. Bezel
— Mini

T.V. MONITOR REPLACEMENT

CAUTION: High voltages may exist in any television unit, even with the power disconnected. Use **EXTREME CAUTION** and do not touch electrical parts or the T.V. yoke area with your hands or with metal objects held in your hands!

In addition, **BE SURE TO USE HEAVY GLOVES** when handling the monitor. You could cut your hands on the metal T.V. chassis without such protection.

DANGER: The T.V. monitor **DOES NOT** contain an isolation transformer on its chassis (it is mounted instead on the floor of the cabinet). When servicing the monitor on a test bench, **YOU MUST ISOLATE THE MONITOR FROM AC VOLTAGE WITH AN ISOLATION TRANSFORMER.**

1. UPRIGHT MODEL: See Figure 3-8.

- ☐ Turn power off to the game.
- ☐ Open the rear access door.
- ☐ Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**
- ☐ Before removing the T.V. monitor, the main-display-glass and bezel must be removed. See above "Upright Model" procedure.
- ☐ With the removal of only four bolts, the T.V. monitor and its mounting bracket will be loose.
- ☐ The monitor mounting bracket slides on top of and against two metal guides mounted to the cabinet's right and left sides. The monitor is removed by sliding it out the back of the cabinet.
- ☐ To reinstall the T.V. monitor, reverse this procedure.
- ☐ After replacing the T.V. monitor, be sure to run the game Self-Test.

2. MINI MODEL: See Figure 3-9.

- ☐ Turn the power off to the game.
- ☐ Open the rear access door.
- ☐ Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**
- ☐ Before removing the T.V. monitor, the main-display-glass and bezel **MUST** be removed. See above "Mini Model" procedure.
- ☐ With the removal of only four bolts, the T.V. monitor will be loose.

CAUTION: **BE SURE** to support the T.V. monitor from the rear while removing the four bolts so it will not fall out of the cabinet.

- ☐ The monitor is removed by supporting it and pulling straight back. (BE CAREFUL not to hit monitor on its rear support bracket.)
- ☐ To reinstall the T.V. monitor, reverse this procedure.
- ☐ After replacing the T.V. monitor, be sure to run the game Self-Test.

3. COCKTAIL TABLE MODEL: See Figure 3-11.

- ☐ Turn the power off to the game.
- ☐ Open the coin box door and release the two latches indicated in Figure 3-10.

CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor. BE CAREFUL!!

- ☐ Once the latches are released, unhook them from their latch plates.
- ☐ Grasp the table top at "A" and open it as indicated in Figure 3-10.

CAUTION: Due to the weight of the monitor, EXTREME CARE MUST be taken when opening the cabinet.

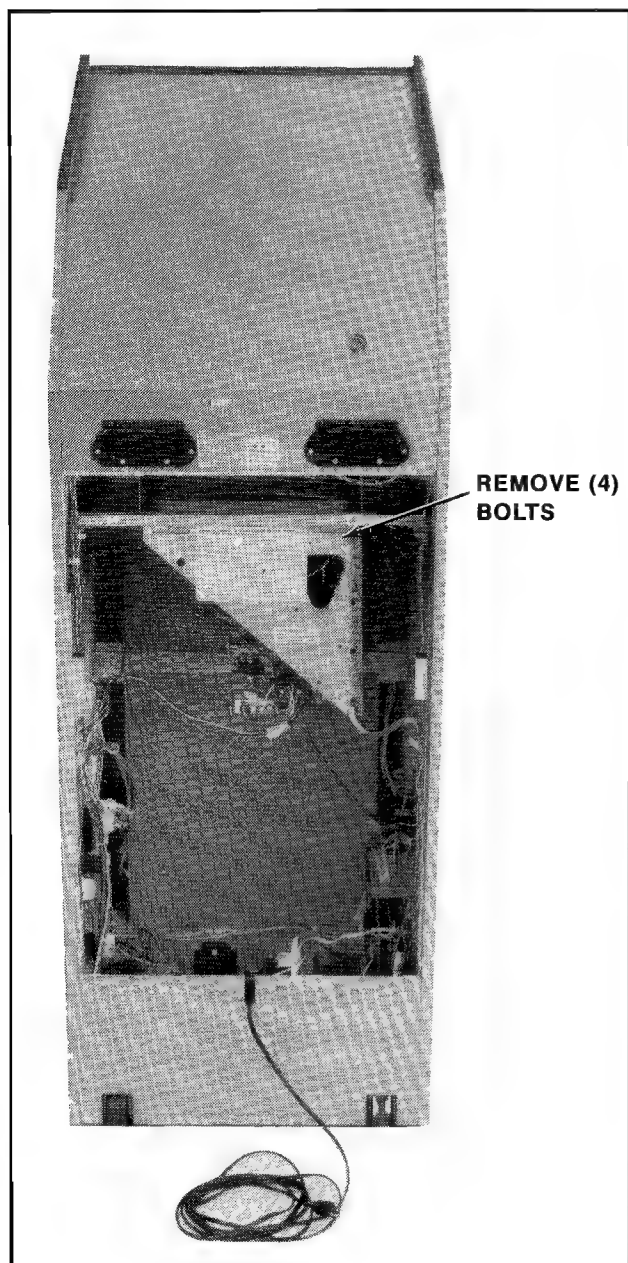


Figure 3-8 Removing the Monitor — Upright

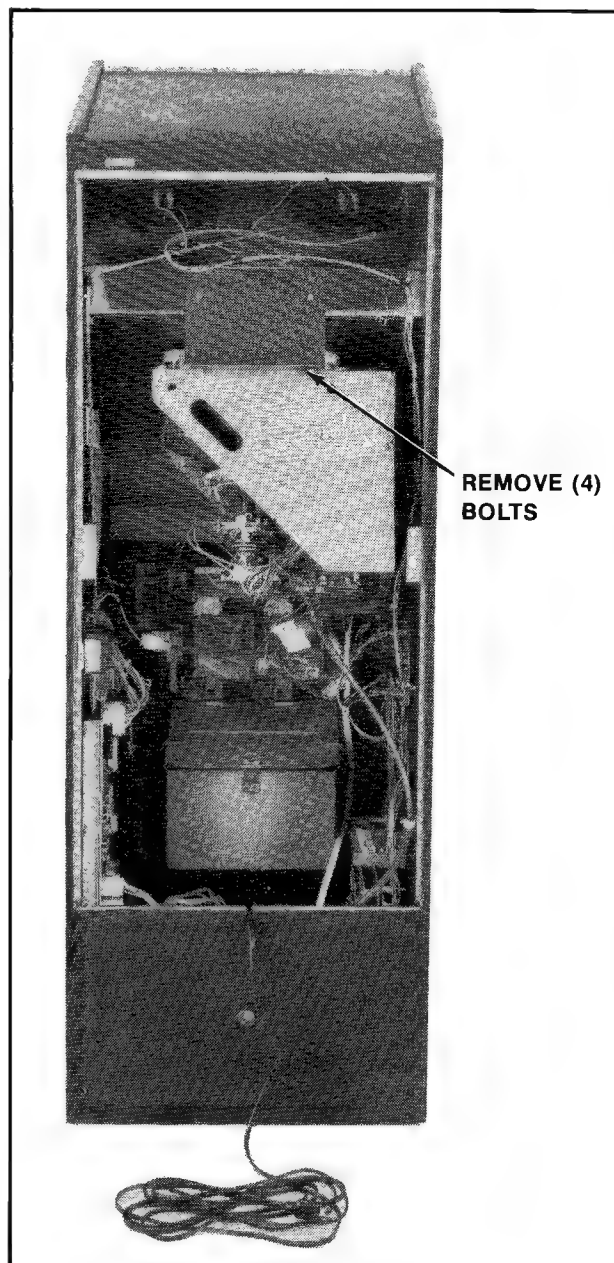


Figure 3-9 Removing the Monitor — Mini

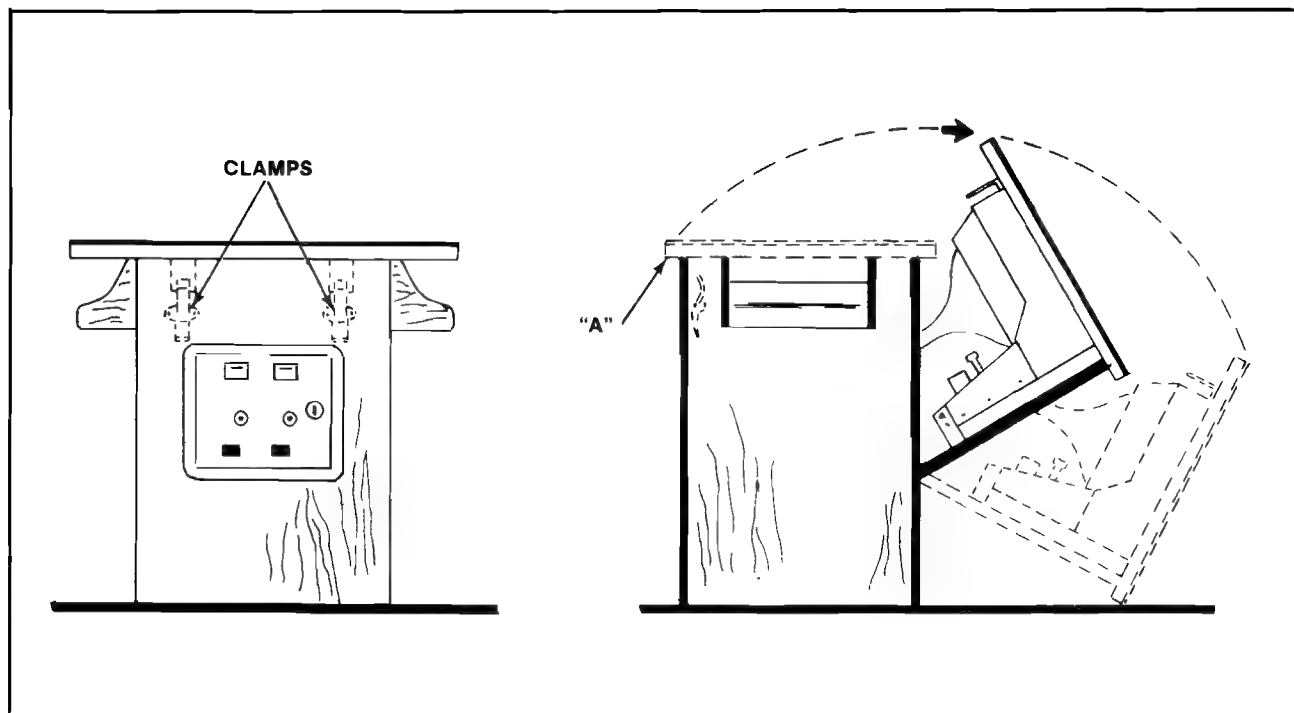


Figure 3-10 Opening the Cocktail Game

- ☐ Remove the screws which hold the table top glass clamps in place.
- ☐ Remove the table top glass.
- ☐ Lift out the T.V. bezel assembly.
- ☐ Completely disconnect the T.V. monitor from all its cabling. **DON'T FORGET THE CHASSIS GROUND WIRE.**
- ☐ Remove the screws holding the T.V. monitor chassis to the "L" brackets by the door hinge(s). See Figure 3-11.
- ☐ Close the Cocktail Table and re-latch it.
- ☐ Remove the screws which secure the T.V. monitor mounting brackets to the edges of the slot cut in the table top. See Figure 3-11.
- ☐ Pry up the end of each monitor mounting bracket with a screwdriver or similar tool until you can grasp them both.
- ☐ Lift the T.V. monitor straight up and out of the table top being very careful not to bump the neck of the picture tube.
- ☐ To reinstall the T.V. monitor assembly, reverse this procedure.
Be sure to check the clearance of the "L" brackets **BEFORE** setting the monitor into the table top.
- ☐ After replacing the T.V. monitor, be sure to run the game Self-Test.

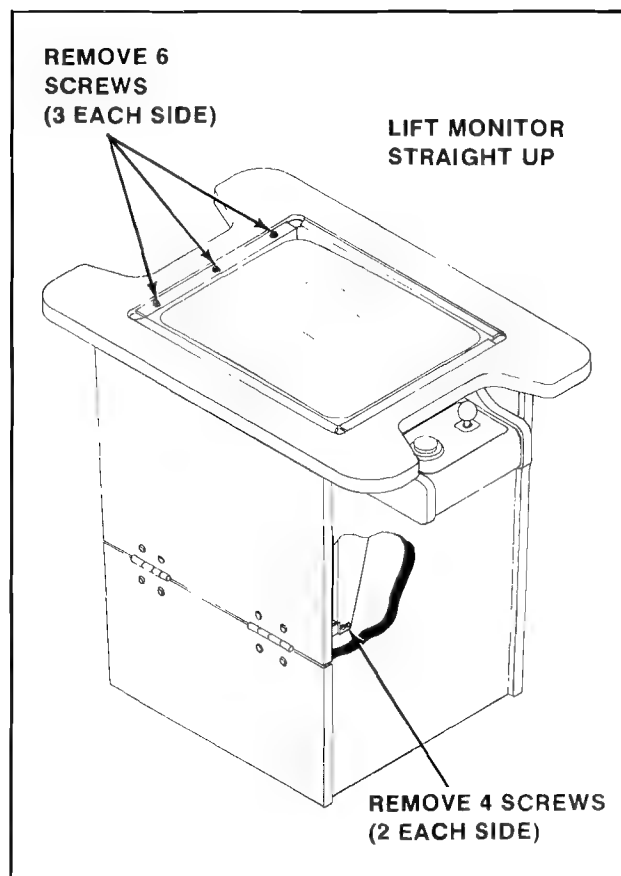


Figure 3-11 Removing the Monitor — Cocktail

PRINTED CIRCUIT BOARD (P.C.B.) REPLACEMENT

1. UPRIGHT MODEL: See Figure 3-12.

- ☐ Turn the power to the game off.
- ☐ Unlock and open the rear access door.
- ☐ Disconnect all cabling from the P.C. boards and lift them out of their card rack.
- ☐ Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 3-12, and slide the linear power supply board out the back of the cabinet.

- ☐ To reinstall the above P.C.B.'s, reverse this procedure.

NOTE: P.C.B.'s are all keyed and will ONLY fit into their connectors one way without forcing them. The plugs on the cable harness which connect it to the P.C.B.'s are also keyed and will ONLY go onto their connectors one way without forcing them.

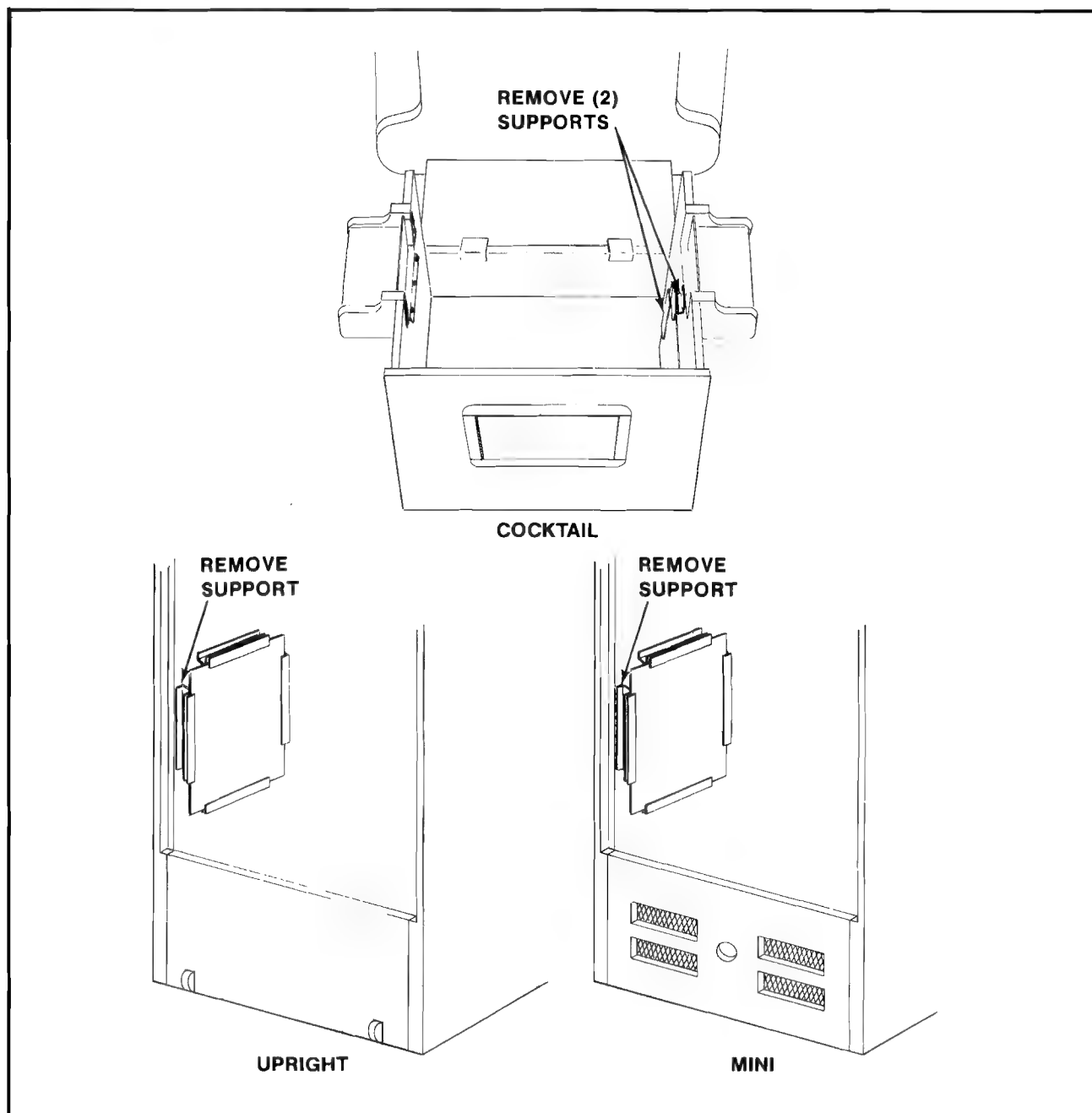


Figure 3-12 Removing P.C.B.'s

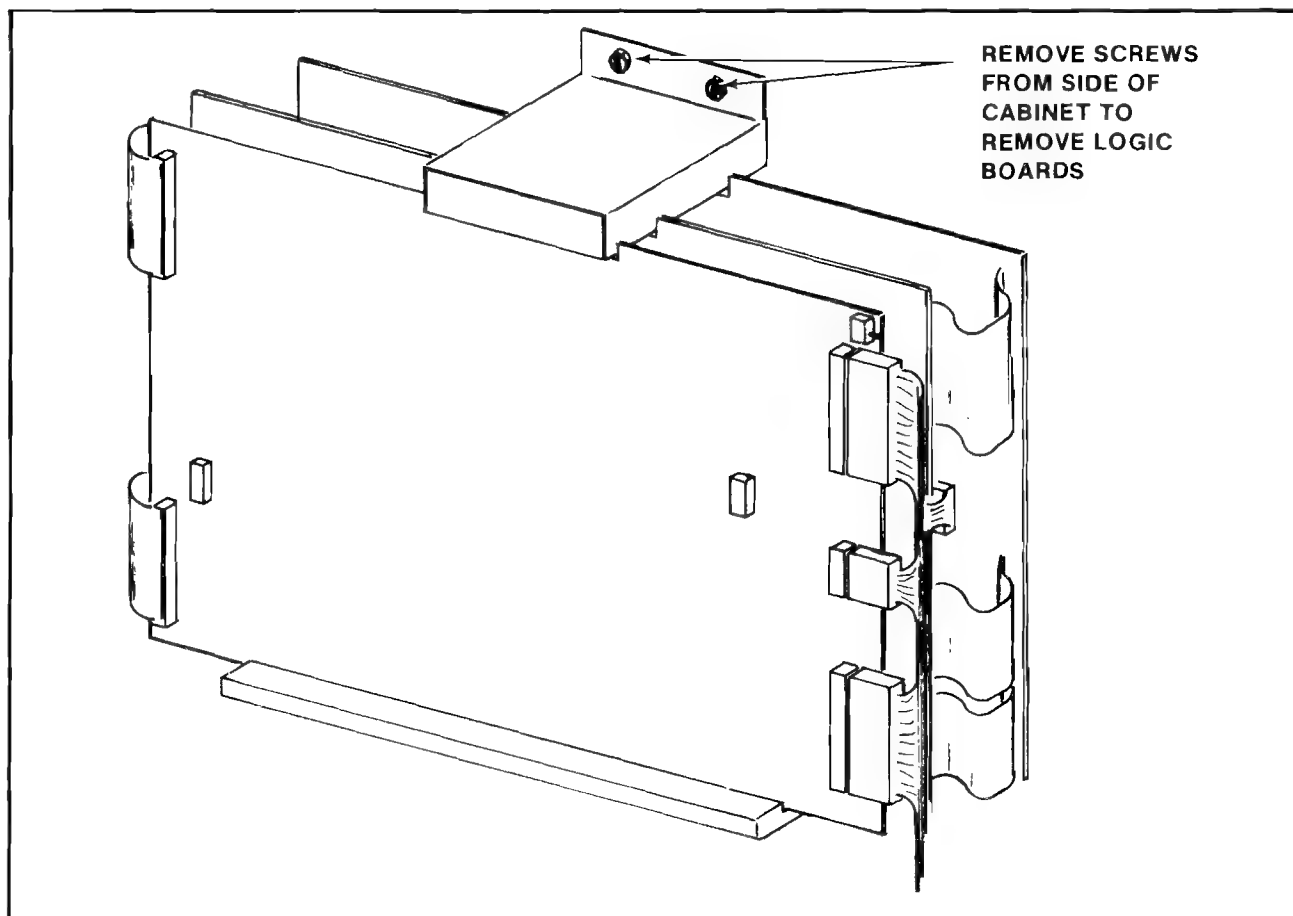


Figure 3-13 Removing P.C.B.'s from Card Rack

2. MINI MODEL: See Figure 3-12.

- ☐ **Turn the power off to the game.**
- ☐ Unlock and open the rear access door.
- ☐ Disconnect all cabling from the P.C. boards and lift them out of their card rack.
- ☐ Disconnect the linear power supply board from all its cabling, remove the P.C.B. supports indicated in Figure 3-12, and slide the linear power supply board out the back of the cabinet.
- ☐ To reinstall the above P.C.B.'s, reverse this procedure.

3. COCKTAIL TABLE MODEL: See Figure 3-12.

- ☐ **Turn the power off to the game.**
- ☐ Open the cabinet:
Open the coin box door and release the two latches indicated in Figure 3-10.

CAUTION: The right hand latch is very close to the HIGH VOLTAGE on the monitor. BE CAREFUL!!

Once they're released, unhook them from their latch plates.

- ☐ Grasp the table top at "A" and open it as indicated in Figure 3-10.

CAUTION: Due to the weight of the monitor, EXTREME CARE MUST be taken when opening the cabinet.

- ☐ To remove the linear power supply board. See Figure 3-12.
Disconnect it from all its cabling.
Remove the two smallest P.C.B. supports.
Once these are removed, the linear power supply can be lifted out the top of the cabinet.
To reinstall the linear power supply board, reverse this procedure.
- ☐ To remove the P.C. boards from the card rack. See Figure 3-13.
Disconnect them from ALL their cabling.
The P.C. boards are now free and can be slid from their rack.
- ☐ To reinstall the P.C. boards, reverse this procedure.

OPENING THE ATTRACTION PANEL

1. UPRIGHT MODEL: See Figure 3-14.

- ☐ **Turn the power to the game off.**
- ☐ Opening the attraction panel:

Remove the screws which secure the top bracket in place. (They are on its top side.) See Figure 3-14.

Remove the top bracket and slide up the attraction panel. This exposes the attraction panel fluorescent light tube and its mounting bracket assembly.

To reinstall the attraction panel, reverse this procedure.
- ☐ The fluorescent light tube may be replaced at this time. **BE CAREFUL NOT TO DROP IT.**

WARNING: If you drop a fluorescent tube and it breaks, IT WILL IMplode! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any fluorescent tube.

- ☐ Replacing the fluorescent tube starter. See Figure 3-15.

Be sure the power to the game has been turned off.

Grasp the starter (it is on the back of the mounting bracket), give it a quarter turn, and remove it from its socket.

To replace the fluorescent light tube starter, reverse this procedure.

- ☐ Replacement of the fluorescent tube mounting bracket assembly.

Be sure the power is off to the game.

Disconnect it from its power cable.

Remove the screws at its right and left hand sides which secure it and gently slide it out of the front of the cabinet, being careful not to catch its power cable on anything.

To reinstall the fluorescent tube mounting bracket assembly, reverse this procedure.

- ☐ Replacing the speaker.

Be sure the power is off to the game.

Remove the attraction panel and disconnect the speaker from its cabling.

Remove the nuts and bolts which secure the speaker and speaker grill in place and set them and the speaker grill aside.

Once the bolts which secure the speaker in place are removed, the speaker may be removed through the opening where the attraction panel was.

Reverse this procedure to reinstall the speaker.

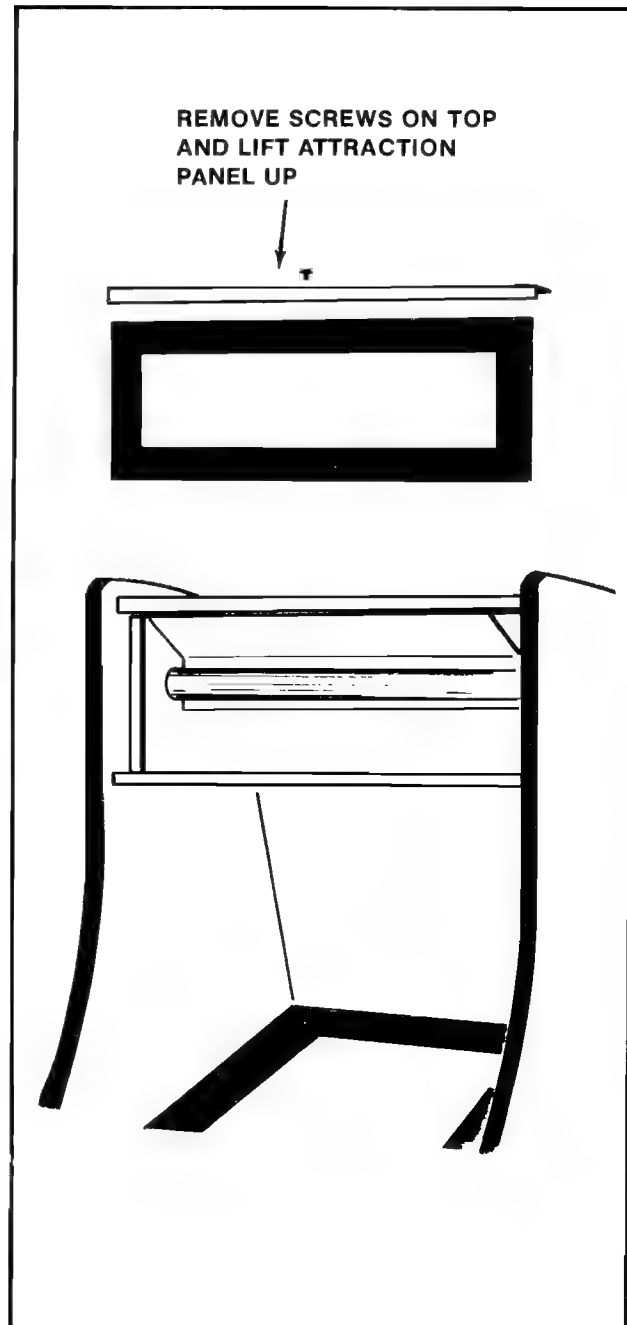


Figure 3-14 Opening the Attraction Panel — Upright

2. MINI MODEL. See Figure 3-16.

- ☐ **Turn the power off to the game.**
- ☐ Remove the screws which secure the top bracket in place. (They are on its top side.) See Figure 3-16.
- ☐ Remove the top bracket and slide up the attraction panel. This exposes the attraction panel light bulbs and their mounting board.

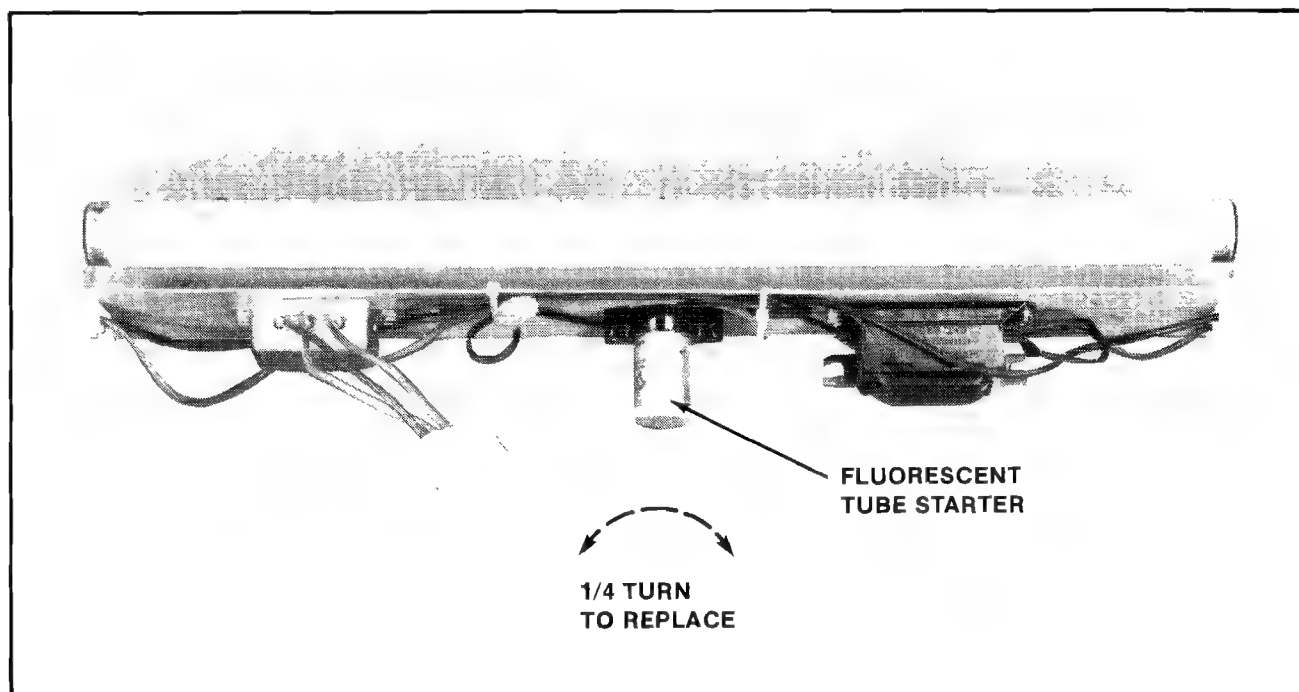


Figure 3-15 Replacing Fluorescent Tube Starter

- To service the light bulbs and their mounting board:

Turn the power to the game back on so you can see which bulbs are burnt out.

Mark the burnt out bulbs and **turn the power to the game back off again.**

To replace the burnt out bulbs, grasp them gently and pull straight out.

The new bulbs are gently pushed into the empty sockets.

To completely replace the light bulb mounting board:

Open the cabinet rear access door and unplug the mounting board from its power cable.

Remove the screws that hold the mounting board to the cabinet.

Gently slide the mounting board out the front of the cabinet being careful not to catch its cable on anything.

To reinstall the above removed items, reverse this procedure.

- To replace the speaker.

Be sure the power is off to the game.

Disconnect the speaker from its cabling.

Remove the nuts and bolts securing the speaker.

Slide the speaker out through the rear access door.

To reinstall the speaker, simply reverse this procedure.

3. THE COCKTAIL TABLE MODEL HAS NO BACK-LIT ATTRACTION PANEL.

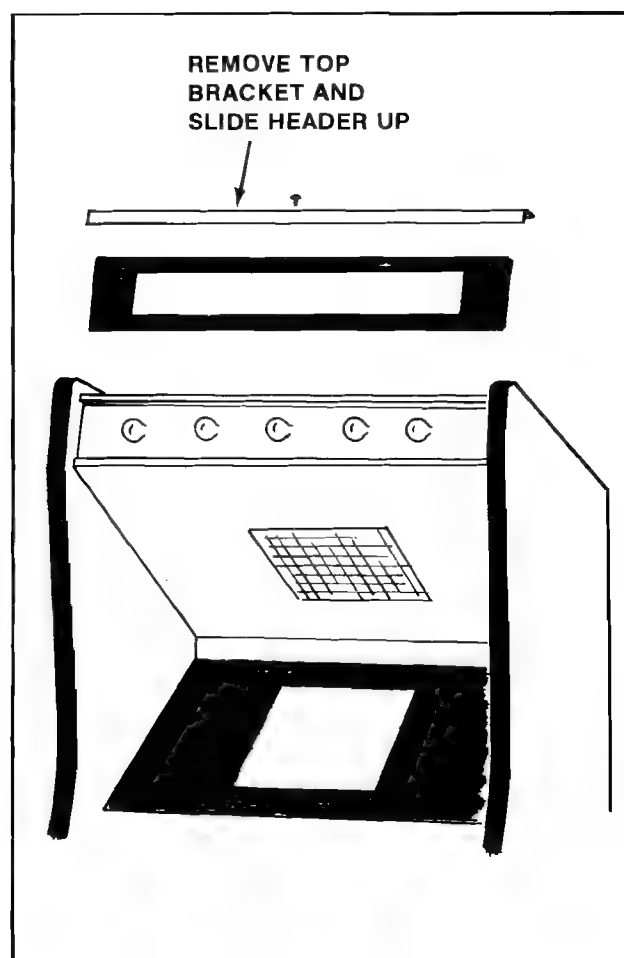


Figure 3-16 Opening the Attraction Panel — Mini

SERVICING THE CONTROL PANEL BLACK LIGHT (CERTAIN UPRIGHT MODELS ONLY)

1. Be sure the power is off to the game.
2. Remove the control panel as described previously. This exposes the bottom row of screws which secure the control panel support bracket and the black light protector in place. See Figure 3-17.
3. Remove all the screws which secure the above items in place and set them aside.

- ☐ The black light tube may be replaced at this time by reaching through the space where the light protector was before you removed it.

WARNING: If you drop a black light tube and it breaks, IT WILL IMplode! Shattered glass can fly six (6) feet or more from the implosion. Use care when replacing any black light tube.

4. Replacing the black light tube starter. See Figure 3-15.

- ☐ Remove the black light tube.
- ☐ Remove the screws which secure the black light tube mounting bracket to the cabinet. See Figure 3-18.

The mounting bracket is now loose and can be pulled out and slightly to one side until you can see the black light tube starter.

- ☐ Grasp the starter (it is on the back of the mounting bracket), give it a quarter turn, and remove it from its socket.

To replace the black light tube starter, reverse this procedure.

5. The black light tube mounting bracket assembly may be replaced at this time by simply disconnecting it from its power cable and removing it from the game.
6. To reinstall any of the above removed items, simply reverse this procedure.

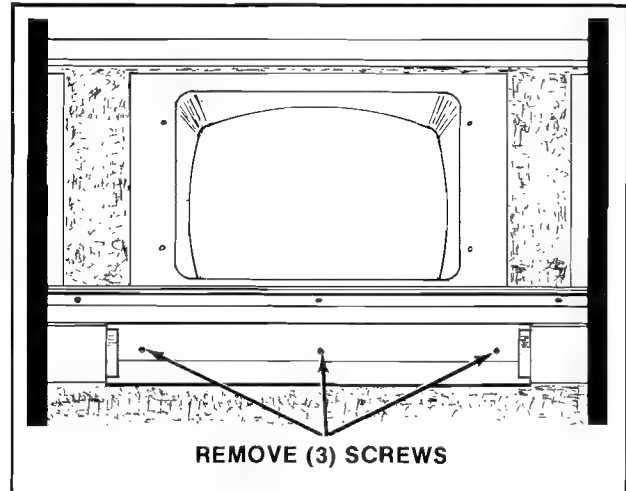


Figure 3-18 Removing Black Light Tube Mtg. Brkt. — Upright

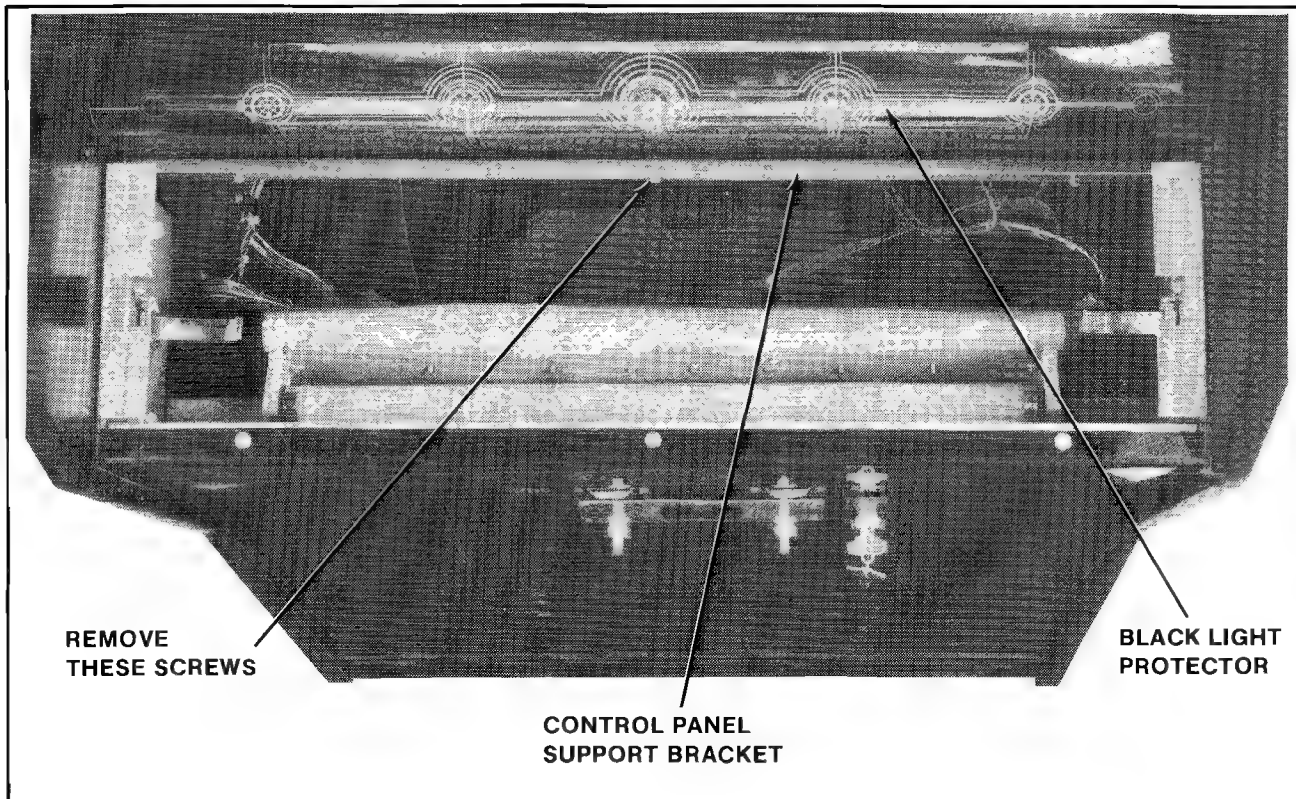


Figure 3-17 Servicing Control Panel Black Light — Upright

IV. Technical Troubleshooting

Introduction

The most common problems occur in harness components such as the coin acceptor, player controls, interconnecting wiring, etc. The TV monitor and PCB computer cause their share of problems too, but not as much as the harness and its component parts. TV monitor troubleshooting will not be covered here because it is covered in that section of this manual.

As you already know, the PCB computer is a complex device with a number of different circuits. Some circuits remain basically the same among games, but overall there are a great many differences between them. PCB troubleshooting procedures, therefore, can be lengthy and will differ greatly among games. However, some basic Z-80 CPU information is involved in this section.

General Suggestions

The first step in any troubleshooting procedure is correctly identifying the malfunction's symptoms. This includes not only the circuits or features malfunctioning, but also those still operational. A carefully trained eye will pick up other clues as well. For instance, a game in which the computer functions fail completely just after money was collected may have a quarter shorting the PCB traces. Often, an experienced troubleshooter will be able to spot the cause of the problem even before opening the cabinet.

After all the clues are carefully considered, the possible malfunctioning areas can be narrowed down to one or two good suspects. Those areas can be examined by a process of elimination until the cause of the malfunction is discovered.

Harness Component Troubleshooting

Typical problems falling in this category are coin and credit problems, power problems and failure of individual features.

NO GAME CREDIT

For example, your prospective player inserts his quarter and is not awarded a game. The first item to check is if the quarter is returned. If the quarter is returned, the malfunction most certainly lies in the coin acceptor itself. First, use a set of test coins (both old and new) to ascertain that the player's coin is not undersize or underweight. If your test coins are also returned, coin acceptor servicing is indicated. Generally, the cause of this particular problem is a maladjusted magnet gate. Normally, this will mean slightly closing the magnet gate a little by turning the adjusting screw out a bit (see section on coin acceptor for more details).

If the quarter is not returned and there is no game credit, the cause of the malfunction may be in one of several areas. First try operating the coin return button; if the coin is returned, the problem is most likely in the magnet gate. Enlarge the gap according to the coin acceptor service procedures. If this does not cure the problem, remove the coin acceptor, clean it and perform the major adjustment procedure.

If the trapped coin is not returned when the wiper lever is actuated, you may have an acceptor jammed by a slug, gummed up with beer, a jammed coin chute, or mechanical failure of the acceptor mechanism. In this case, first check for the slug that will generally be trapped against the magnet. If so, simply remove the slug and test the acceptor. If the chute is blocked, remove the acceptor and remove the jammed coins. If there is actual failure of the acceptor, remove the unit and repair as indicated in the coin acceptor service procedures.

If the coin is making its way through the acceptor (that is, falling into the coin box), yet there is still no game credit, you either have a mechanical failure of the coin switch or electrical failure of the coin and credit circuits. The first place to begin is by checking the coin switch. Most of these switches are the make/break variety of micro switch, which is checked by testing for continuity between the NO, NC, and C terminals. When not actuated, the NC and C terminals should be continuous and the NO terminal open. When operated, the NO and C terminals should close and the NC should be open. If the coin switch checks out, examine the connections to the terminals to make sure there is good contact. If necessary, use the continuity tester and check from the terminal lug on the switch to the associated PCB trace. This will tell you if there is a continuous line all the way to the credit circuit.

If the coin switch wires do not check out, the problem is in the computer — most likely in the coin and credit circuitry.

If you do get game credit when a coin is deposited, but the game will not start when the start switch is pressed, you may have a problem in the start switch, the interconnecting wiring or in the computer. First check the switch. If the switch is OK, proceed to check the wiring. Again, make sure you go from the terminal lug on the switch to the PCB trace. This way, you will check the terminal contact as well as PCB edge connector contact. If the wiring is continuous, proceed to check the PCB credit circuit. If not, check each section of the wiring, until the discontinuity is located. If the wiring is OK, the problem must lie in the computer.

Transformer and Line Voltage Problems

Your machine must have the correct line voltage to operate properly. If the line voltage drops too low, a circuit in the computer will disable game credit. The point at which the computer will fail to work will vary some from game to game, but no game will work on line voltage that drops below 105 VAC.

Low line voltage may have many causes. Line voltage normally fluctuates a certain amount during the day as the total usage varies. Peak usage times occur mainly at dawn or dusk, so if your machine's malfunction seems to be related to the time of day, this may be a factor. A large load connected to the same line as the game (such as a large air conditioner or other device with an exceptionally large motor) may drop the line voltage significantly when starting up. This drop can result in an intermittent credit problem. In addition, poor connections in the location wiring, plug, or line cord may also cause a significant drop in power. Cold solder joints in the game's harness, especially in areas like the transformer connections, interlock switch, or fuse block, may also produce the same results, although probably on a more permanent basis.

Sometimes location owners (especially in bars) replace light switches with dimmer rheostats, and the game is sometimes on the same line. Obviously, the voltage available to the game is going to drop dramatically when the dimmer is turned.

In any case, the way to check for correct line voltage is with your VOM. Set the VOM to 250 VAC and stick the probes in the wall receptacle. If it's OK here, check the transformer primary connections. If you do not get 117 VAC, examine the solder joints on the transformer, fuse block, and interlock switch. If you do get 117 VAC, the problem must be either in the transformer, harness connections, or in the PCB power supply.

If you suspect the transformer, check its secondaries with the VOM set to 50 VAC and correlate the readings with the legend on the side of the transformer. The transformer must also be correctly grounded, so check the ground potential as well, especially if there is a hum bar rolling up or down the TV screen.

HARNESS PROBLEMS

Other harness problems include blowing fuses and malfunctioning controls. The repeating blown-fuse problem can sometimes be quite exasperating to solve, for short circuits have the tendency to occur in areas almost impossible to find. First, try inserting a new fuse, as old fuses age and blow without cause. If the new one also blows, you definitely have a short.

The best way to approach this problem is by turning the power off and disconnecting devices that may be causing the problem, such as the TV, transformer, and PCB. Disconnect the devices by pulling off their connectors, but do not allow them to touch. If necessary, insulate them with small pieces of electrical tape. Then, connect your VOM across the terminals of the fuse block (all electrical power shut off), and set it to one of the resistance scales. This will save blowing a fuse each time you want to check the circuit.

If the VOM reveals that disconnecting the devices removed the short, reconnect the devices one by one until the short returns. The last device connected is the one that is at fault. If the VOM reads a short even after the devices are disconnected, the fault must lie in the harness itself, and only patient exploration will reveal its location. First, carefully examine all the wiring, looking for terminals that may be touching, metal objects such as coins shorting connections or burned insulation. If necessary, use the VOM to check each suspected wire.

MALFUNCTIONING CONTROLS

One of the most common problems here is a bad potentiometer. Typically, a bad pot will cause the image to jump as it reaches a certain point. The only cure for this one is to install a new pot.

If a feature that is operated by a switch (for example, joysticks, foot pedals, control panel buttons) does not operate at all, check the switch with a VOM or continuity tester to verify its operation. If the switch does not check out, replace it. If the switch is OK, you should suspect the input to the switch from the PCB. In this case, get out the harness and logic schematics and check to see what kind of input it is. In many cases, the input will be +5 VDC. If so, use the VOM to check its presence. Normally, the switch is used to pull a +5 VDC line LOW to GND or to pull a LOW line HIGH. If the PCB output is missing, check the wire length from the PCB. If you find the signal at the PCB trace, the wire length or connection is at fault. If not, begin exploring the PCB using the logic schematics.

A Glossary of Microprocessor Terms

MICROPROCESSOR — one or several microcircuits that perform the function of a computer's CPU. Sections of the circuit have arithmetic and comparative functions that perform computations and executive instructions.

CPU — central-processing unit. A computing system's "brain", whose arithmetic, control and logic elements direct functions and perform computations. The microprocessor section of a microcomputer is on one chip or several chips.

PROM — programmable read-only memory. User permanently sets binary on-off bits in each cell by selectively fusing or not fusing electrical links. Non-erasable. Used for low-volume applications.

EPROM — erasable, programmable, read-only memory. Can be erased by ultraviolet light bath, then reprogrammed. Frequently used during design and

development to get programs debugged, then replaced by ROM for mass production.

ROM — read-only memory. The program, or binary on-off bit pattern, is set into ROM during manufacture, usually as part of the last metal layer put onto the chip. Nonerasable. Typical ROM's contain up to 16,000 bits of data to serve as the microprocessor's basic instructions.

RAM — random-access memory. Stores binary bits as electrical charges in transistor memory cells. Can be read or modified through the CPU. Stores input instructions and results. Erased when power is turned off.

LSI — large scale integration. Formation of hundreds or thousands of so-called gate circuits on semiconductor chips. Very large scale integration (VLS) involves microcircuits with the greatest component density.

MOS — metal-oxide semiconductor. A layered construction technique for integrated circuits that achieves high component densities. Variations in MOS chip structures create circuits with speed and low-power requirements, or other advantages (static will damage a MOS chip).

Introduction to the Z-80 CPU

The term "microcomputer" has been used to describe virtually every type of small computing device designed within the last few years. This term has been applied to everything from simple "microprogrammed" controllers constructed out of TTL MSI up to low end minicomputers with a portion of the CPU constructed out of TTL LSI "bit slices." However, the major impact of the LSI technology within the last few years has been with MOS LSI. With this technology, it is possible to fabricate complete and very powerful computer systems with only a few MOS LSI components.

The Zilog Z-80 family of components can be configured with any type of standard semiconductor memory to generate computer systems with an extremely wide range of capabilities. For example, as few as two LSI circuits and three standard TTL MSI packages can be combined to form a simple controller. With additional memory and I/O devices a computer can be constructed with capabilities that only a minicomputer could previously deliver.

New products using the MOS LSI microcomputer are being developed at an extraordinary rate. The Zilog Z-80 component set has been designed to fit into this market through the following factors:

1. The Z-80 is fully software compatible with the popular 8080A CPU.
2. Existing designs can be easily converted to include the Z-80.
3. The Z-80 component set is at present superior in both software and hardware capabilities to any other microcomputer system on the market today.
4. For increased throughput the Z80A operating at a 4 MHz clock rate offers the user significant speed advantages.

Microcomputer systems are extremely simple to construct using Z-80 components. Any such system consists of three parts:

1. **CPU (Central Processing Unit)**
2. **Memory**
3. **Interface Circuits to peripheral devices**

The CPU is the heart of the system. Its function is to obtain instructions from the memory and perform the desired operations. The memory is used to contain instructions and in most cases data that is to be processed. For example, a typical instruction sequence may be to read data from a specific peripheral device, store it in a location in memory, check the parity and write it out to another peripheral device. Note that the Zilog component set includes the CPU and various general purpose I/O device controllers, while a wide range of memory devices may be used from any source. Thus, all required components can be connected together in a very simple manner with virtually no other external logic.

General Purpose Registers

There are two matched sets of general purpose registers, each set containing six 8-bit registers that may be used individually as 8-bit registers or as 16-bit register pairs by the programmer. One set is called BC, DE and HL while the complementary set is called BC', DE' and HL'. At any one time the programmer can select either set of registers to work with through a single exchange command for the entire set. In systems where fast interrupt response is required, one set of general purpose registers and an accumulator/flag register may be reserved for handling this very fast routine. Only a simple exchange command need be executed to go between the routines. This greatly reduces interrupt service time by eliminating the requirement for saving and retrieving register contents in the external stack during interrupt or subroutine processing. These general purpose registers are used for a wide range of applications by the programmer. They also simplify programming, especially in ROM based systems where little external read/write memory is available.

Arithmetic & Logic Unit (ALU)

The 8-bit arithmetic and logical instructions of the CPU are executed in the ALU. Internally the ALU communicates with the registers and the external

data bus on the internal data bus. The type of functions performed by the ALU include:

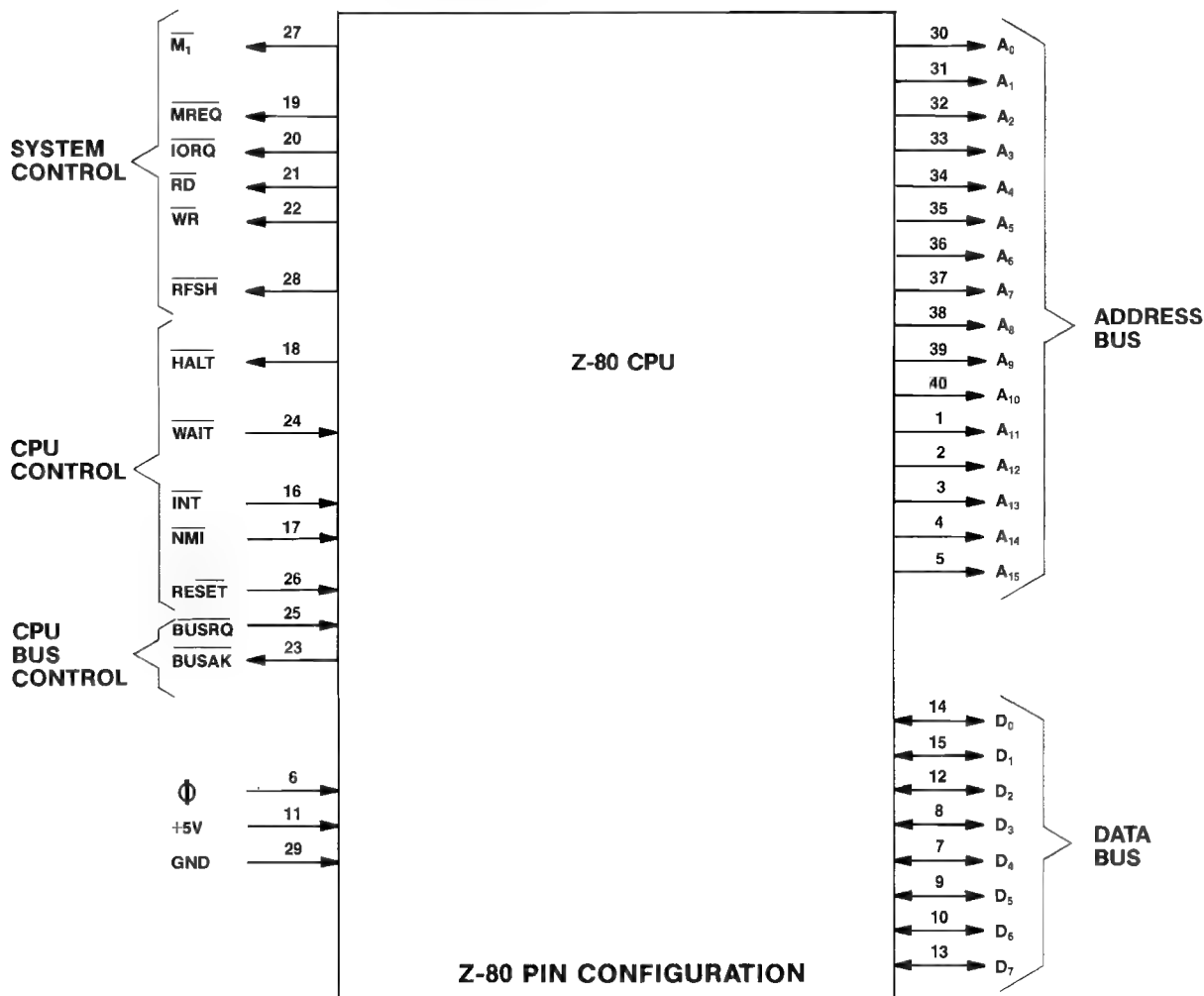
Add	Left or right shifts or rotates (arithmetic and logical)
Subtract	Increment
Logical AND	Decrement
Logical OR	Set bit
Logical Exclusive OR	Reset bit
Compare	Test bit

Instruction Register and CPU Control

As each instruction is fetched from memory, it is placed in the instruction register and decoded. The control sections performs this function and then generates and supplies all of the control signals necessary to read or write data from or to the registers, control the ALU and provide all required external control signals.

Z-80 CPU Pin Description

The Z-80 CPU is packaged in an industry standard 40 pin Dual In-Line Package. The I/O pins are shown in the below figure and the function of each is described.



A₀-A₁₅**(Address Bus)**

Tri-state output, active high. A₀-A₁₅ constitute a 16-bit address bus. The address bus provides the address for memory (up to 64K bytes) data exchanges and for I/O device data exchanges. I/O addressing uses the 8 lower address bits to allow the user to directly select up to 256 input or 256 output ports. A₀ is the least significant address bit. During refresh time, the lower 7 bits contain a valid refresh address.

D₀-D₇**(Data Bus)**

Tri-state input/output, active high. D₀-D₇ constitute an 8-bit bidirectional data bus. The data bus is used for data exchanges with memory and I/O devices.

M₁**(Machine Cycle one)**

Output, active low. M₁ indicates that the current machine cycle is the OP code fetch cycle of an instruction execution. Note that during execution of 2-byte op-codes, M₁ is generated as each op code byte is fetched. These two byte op-codes always begin with CBH, DDH, EDH or FDH. M₁ also occurs with IORQ to indicate an interrupt acknowledge cycle.

MREQ**(Memory Request)**

Tri-state output, active low. The memory request signal indicates that the address bus holds a valid address for a memory read or memory write operation.

IORQ**(Input/Output Request)**

Tri-state output, active low. The IORQ signal indicates that the lower half of the address bus holds a valid I/O address for a I/O read or write operation. An IORQ signal is also generated with an M₁ signal when an interrupt is being acknowledged to indicate that an interrupt response vector can be placed on the data bus. Interrupt Acknowledge operations occur during M₁ time while I/O operations never occur during M₁ time.

RD**(Memory Read)**

Tri-state output, active low. RD indicates that the CPU wants to read data from memory or an I/O device. The addressed I/O device or memory should use this signal to gate data onto the CPU data bus.

WR**(Memory Write)**

Tri-state output, active low. WR indicates that the CPU data bus holds valid data to be stored in the addressed memory or I/O device.

RFSH**(Refresh)**

Output, active low. RFSH indicates that the lower 7 bits of the address bus contain a refresh address for dynamic memories and the current MREQ signal should be used to do a refresh read to all dynamic memories.

HALT**(Halt state)**

Output, active low. HALT indicates that the CPU has executed a HALT software instruction and is awaiting either a non maskable or a maskable interrupt (with the mask enabled) before operation can resume. While halted, the CPU executes NOP's to maintain memory refresh activity.

WAIT**(Wait)**

Input, active low. WAIT indicates to the Z-80 CPU that the addressed memory or I/O devices are not ready for a data transfer. The CPU continues to enter wait states for as long as this signal is active. This signal allows memory or I/O devices of any speed to be synchronized to the CPU.

INT**(Interrupt Request)**

Input, active low. The Interrupt Request signal is generated by I/O devices. A request will be honored at the end of the current instruction if the internal software controlled interrupt enable flip-flop (IFF) is enabled and if the BUSRQ signal is not active. When the CPU accepts the interrupt, an acknowledge signal (IORQ during M₁ time) is sent out at the beginning of the next instruction cycle. The CPU can respond to an interrupt in three different modes that are described in detail in section 5.4 (CPU Control Instructions).

NMI**(Non-Maskable Interrupt)**

Input, negative edge triggered. The non maskable interrupt request line has a higher priority than INT and is always recognized at the end of the current instruction, independent of the status of the interrupt enable flip-flop. NMI automatically forces the Z-80 CPU to restart to location 0066H. The program counter is automatically saved in the external stack so that the user can return to the program that was interrupted. Note that continuous WAIT cycles can prevent the current instruction from ending, and that a BUSRQ will override a NMI.

RESET

Input, active low. RESET forces the program counter to zero and initializes the CPU. The CPU initialization includes:

- 1) Disable the interrupt enable flip-flop

- 2) Set Register I = 00_H
- 3) Set Register R = 00_H
- 4) Set Interrupt Mode 0

During reset time, the address bus and data bus go to a high impedance state and all control output signals go to the inactive state.

BUSRQ

(Bus Request)

Input, active low. The bus request signal is used to request the CPU address bus, data bus and tri-state output control signals to go to a high impedance state so that other devices can control these buses. When BUSRQ is activated, the CPU will set these

buses to a high impedance state as soon as the current CPU machine cycle is terminated.

BUSAK

(Bus Acknowledge)

Output, active low. Bus acknowledge is used to indicate to the requesting device that the CPU address bus, data bus and tri-state control bus signals have been set to their high impedance state and the external device can now control these signals.

CLK

(Clock)

Single phase TTL level clock which requires only a 330 ohm pull-up resistor to +5 volts to meet all clock requirements.

**MCR II SYSTEM
P.C. BOARD JUMPER OPTIONS**

VIDEO GENERATOR P.C. BOARD									
MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	JW#7	JW#8
MOTOROLA	68764	#	*	*	#	*	*	*	*
	68766	#	*	*	#	*	*	*	*
INTEL	2764	*	#	#	*	#	*	*	#
T. I.	2564	#	*	*	#	*	#	#	*
C.P.U. P.C. BOARD									
MANUFACTURER	EPROM NO.	JW#1	JW#2	JW#3	JW#4	JW#5	JW#6	NOTE: JUMPER OP- TION FOR PROGRAM ROMs ONLY.	
NUMEROUS MFR'S	2532	*	#	*	*	#	*		
NUMEROUS MFR'S	2732	*	#	*	*	*	#		
SOUND I/O P.C. BOARD									
MANUFACTURER	EPROM NO.	JW#1	JW#2						
NUMEROUS MFR'S	2532	*	#						
NUMEROUS MFR'S	2732	#	*						

= LEAVE JUMPER WIRES WHERE THIS SYMBOL “#” APPEARS

***** = CUT JUMPER WIRES WHERE THIS SYMBOL “*” APPEARS.

The above table illustrates the fact that the Video Generator P.C. Board used in the MCR II System has 8 jumper wires, the C.P.U. P.C. Board used in the MCR II System has 6 jumper wires, and the Sound I/O P.C. Board used in the MCR II System has 2 jumper wires.

All of the above Boards can be used with a variety of different **SETS of EPROM chips**. However, these EPROMS are not all made by the same manufacturer and do have some internal differences. So, in order to make them function properly in their respective P.C. Boards, certain jumper wires on these Boards have to be cut.

The above table tells you which jumpers to cut (depending on which EPROM set you're going to use) by showing a “*” under that jumper wires number. If there is a “#” under a jumper wires number, **THAT PARTICULAR JUMPER WIRE IS NOT TO BE CUT.**

V. Coin Door Maintenance

SPECIAL NOTE: If you have any questions about the coin acceptors in your game(s), please feel free to contact their manufacturers. Each manufacturer's name is **PROMINENTLY** imprinted on every acceptor mechanism.

Metal mechanisms only:

COIN MECHANISMS, INC.
817 Industrial Drive
Elmhurst, IL 60126
Phone (312) 279-9150

Metal and Plastic mechanisms:

COINCO COIN ACCEPTORS, INC.
860 Eagle Drive
Bensenville, IL 60106
Phone (312) 766-6781

COIN DOOR MAINTENANCE

METAL COIN ACCEPTOR MECHANISMS

Periodically, the metal coin acceptor mechanism(s) must be removed from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.

3. Remove the coin acceptor mechanism as shown in Figure 5-1.

- ☐ Push down on the two spring loaded latches.
- ☐ While holding the latches down, pull the top of the coin acceptor mechanism toward you.
- ☐ Release the latches and lift out the coin acceptor mechanism.

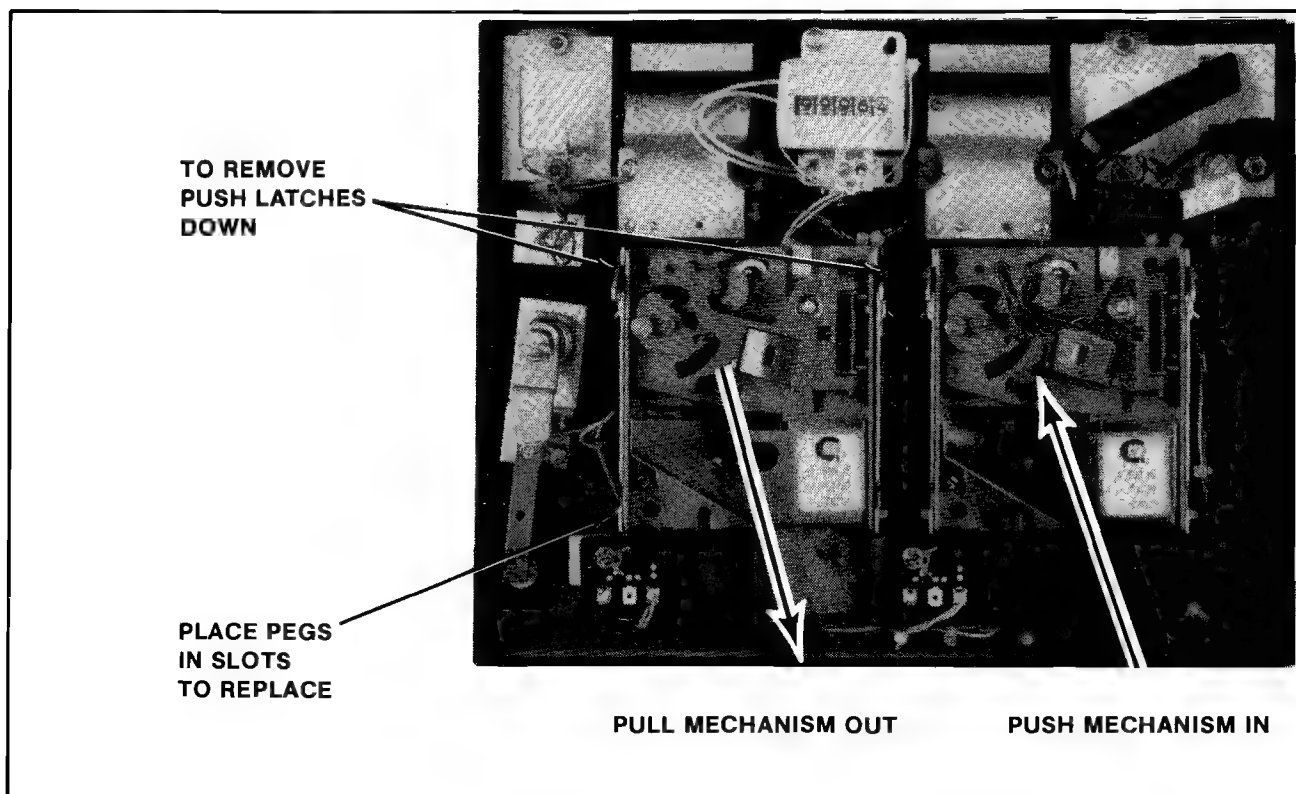


Figure 5-1 Removing and Replacing the Coin Acceptor

4. Clean the magnet of all foreign particles. See Figure 5-2.

□ This may be accomplished by swinging the gate open as shown in the above figure.

5. Remove the cradles and undersize levers and clean the bushings. (A pipe cleaner makes a good bushing cleaner.)

□ Also clean the pivot pin.

6. Whenever needed, the coin acceptor should be cleaned with hot water and cleanser in the following manner:

□ Place the coin acceptor in boiling water for about ten minutes.

CAUTION: BE CAREFUL NOT TO BURN YOURSELF.

□ Next, use a brush and kitchen cleaner to remove all remaining foreign matter from the unit.

□ Rinse the coin acceptor in clean boiling water.

□ Dry the coin acceptor thoroughly by using filtered compressed air to blow it dry.

NOTE: The reason we recommend using boiling water is that it evaporates faster than cold water and speeds drying time.

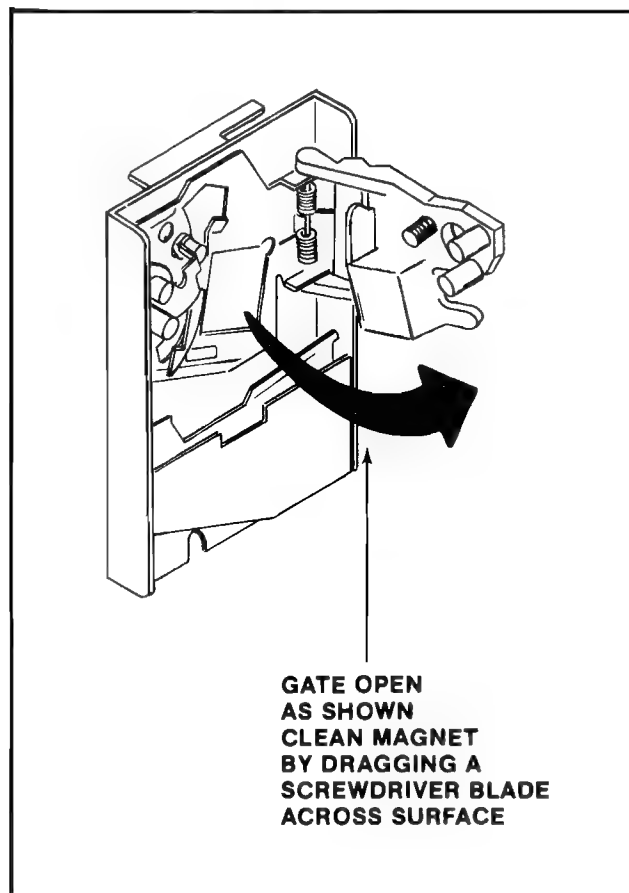


Figure 5-2 Cleaning the Metal Coin Acceptor

7. To lubricate the coin acceptor:

□ Use **ONLY** powdered graphite and put it **ONLY** on the moving parts of the coin acceptor. These parts are called out in Figure 5-3.

□ Be extremely careful to keep the powdered graphite away from paths that are traveled by the coins.

**— WARNING —
DO NOT USE OIL
TO LUBRICATE THE
COIN ACCEPTOR.**

8. Check the coin chute for obstructions such as: paper, gum, etc.

9. Reinstall the coin acceptor to the coin door. See Figure 5-1.

□ Place the two pegs at the coin acceptor's base into their retaining slots.

□ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.

10. Close and lock the coin door.

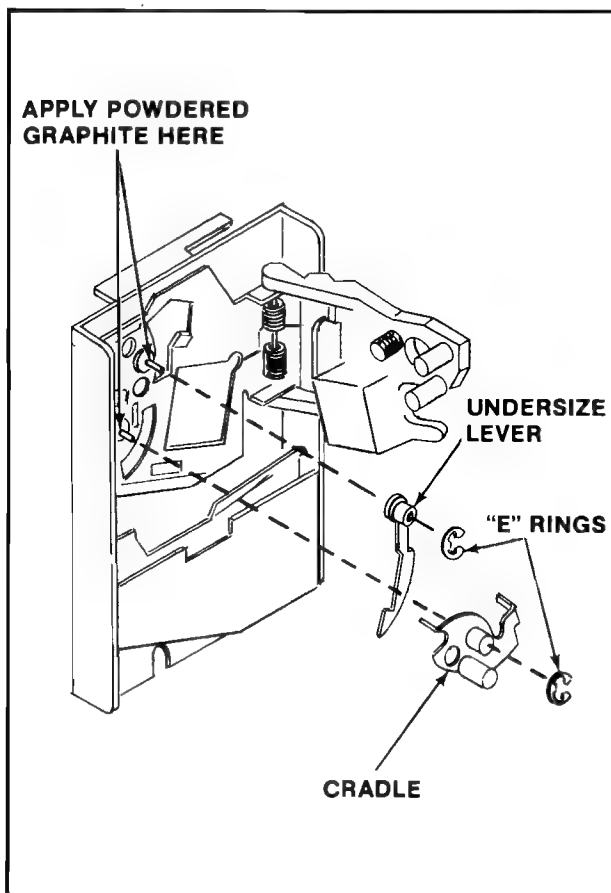


Figure 5-3 Lubricating the Metal Coin Acceptor

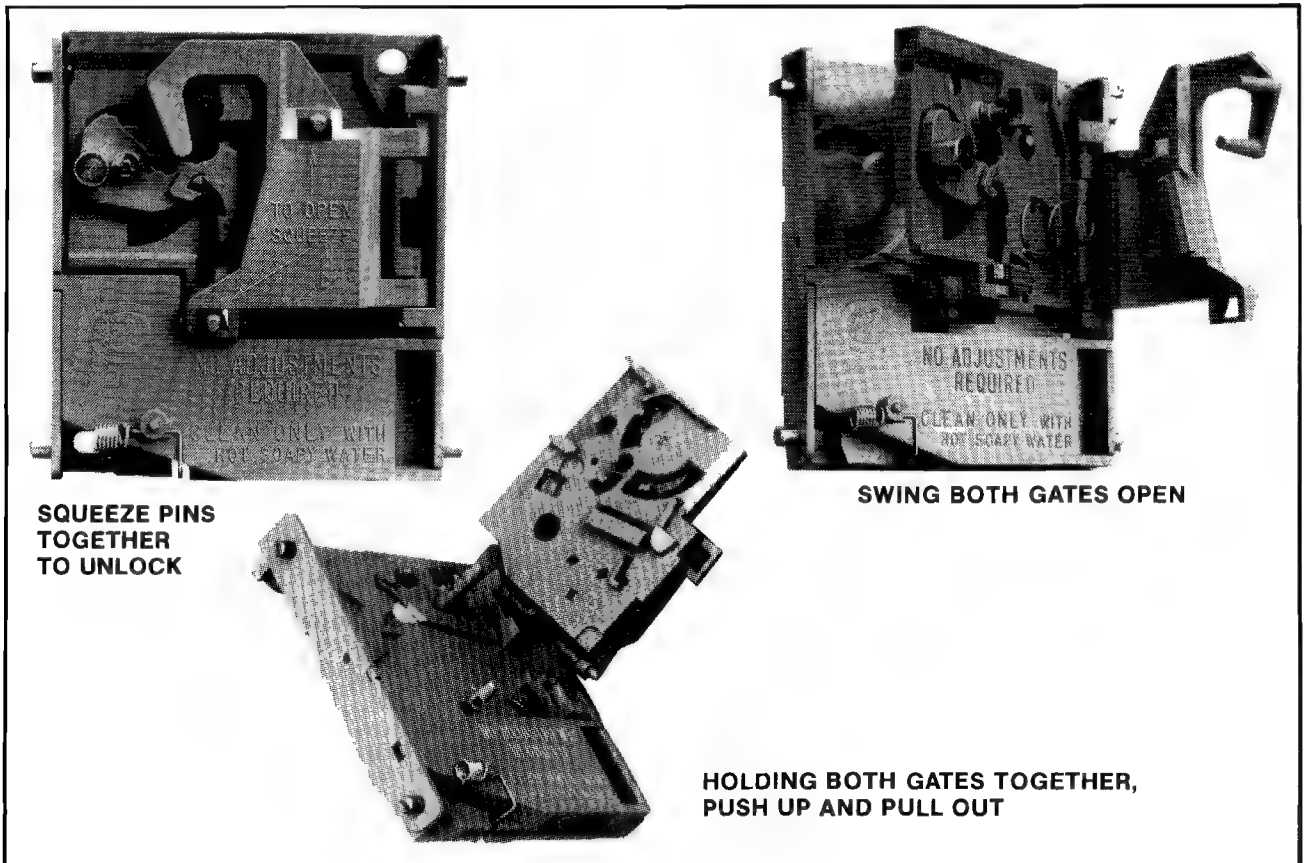


Figure 5-4 Opening the Plastic Coin Acceptor

PLASTIC COIN ACCEPTOR MECHANISMS

The plastic coin acceptor mechanism(s) must be removed periodically from the coin door and cleaned.

1. **Make sure the power to the game is off.**
2. Unlock and open the coin door.
3. Remove the coin acceptor mechanism(s) as shown in Figure 5-1.
 - ☐ Push down on the two spring loaded latches.
 - ☐ While holding the latches down, pull the top of the acceptor mechanism toward you.
 - ☐ Release the latches and lift out the mechanism.
4. Squeeze the two pins indicated in Figure 5-4 together to open the mechanism and break it down into its three basic parts.
 - ☐ Clean the mechanism in hot soapy water. It never rusts.
 - ☐ Rinse the mechanism in clean hot water and allow it to dry.

- ☐ Reassemble the mechanism (it never needs lubrication).

5. Check the coin chute for obstructions such as: paper, gum, etc.
6. Reinstall the coin acceptor to the coin door. See Figure 5-5.
 - ☐ Place the two pegs at the coin acceptor's base into their retaining slots.
 - ☐ Now push the top of the coin acceptor toward the coin door until it snaps in place and is held there by the two spring loaded latches.
7. Close and lock the coin door.

NOTE: See Figure 5-6 for instructions on how to set the plastic coin acceptor mechanisms to either accept or reject Canadian quarters.

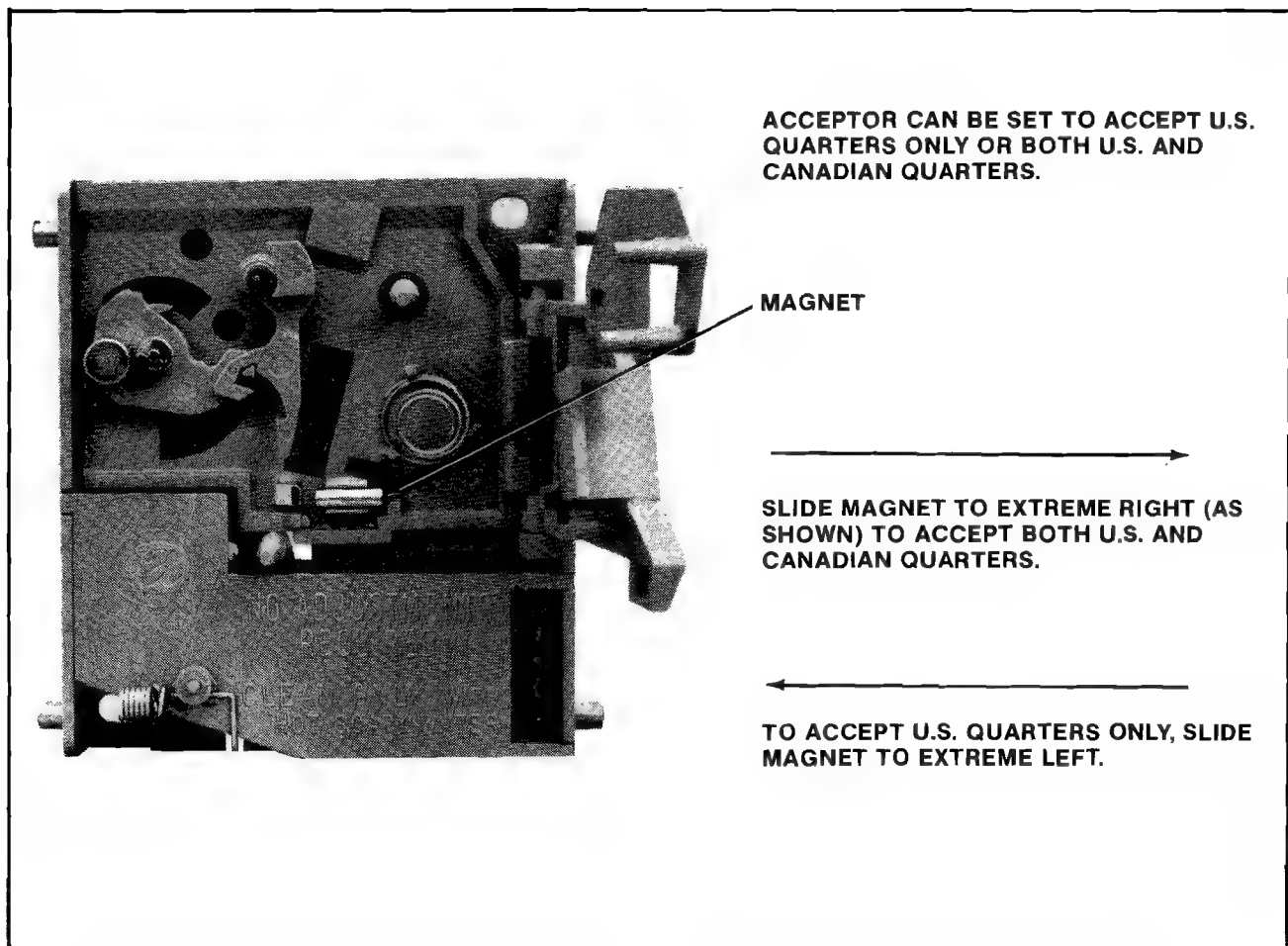


Figure 5-5 Changing the Plastic Coin Acceptor to Accept American or Canadian Quarters

PLEASE NOTE:

THE INFORMATION CONTAINED IN THIS SECTION IS TOLD IN AN EASY TO UNDERSTAND MANNER AND IS INTENDED TO AID THOSE WITHOUT AN ELECTRONICS DEGREE IN TROUBLESHOOTING AND REPAIRING THEIR GAMES T.V. MONITOR.

IF YOU READ THROUGH THIS SECTION AND STILL HAVE QUESTIONS, PLEASE CONTACT YOUR DISTRIBUTOR OR MIDWAY MANUFACTURING COMPANY AT THE TOLL FREE NUMBER PROVIDED WITH YOUR GAMES PAPERS.

OUR STAFF AND OUR DISTRIBUTORS STAND READY TO HELP YOU!

THANK YOU

VI. T.V. Monitor Manual

Introduction: (How to use this section of your manual.)

This section has been designed to simply familiarize you with one of the more mystical components in your game — the T.V. monitor. If you are an electronics technician who is quite knowledgeable on the subject, you may decide to just go to the schematics and start troubleshooting the defective monitor. But if you are like most people, a monitor is a T.V. set, and that means a complex doo-dad that means big buck repairs. This isn't necessarily so. This section of the manual will acquaint you with the monitor and could just help you repair it if you feel adventurous enough to give it a try. If you have any knowledge of electronics, especially the use of a voltmeter, the repairs you can make are astonishing. Just keep in mind that **ELECTRICITY CAN BE VERY DANGEROUS, SO BE CAREFUL!!**

If you want to understand how a monitor works, just read the "THEORY OF OPERATION" subsection. If you wish, you can follow along with the schematics. The information is presented in a very basic manner but a more complete treatment of the subject can be found in the technical sections of bookstores.

If you want to attempt to repair your monitor, it would be a good idea to read this whole section beginning to end before starting. **Pay attention to all warnings**

and take them seriously. The more equipment you have the better, but a low cost Volt-Ohm-Milliameter can often do the trick. Here are the steps to take:

1. Find the symptom that matches the problems your monitor has in the "SYMPTOM — DIAGNOSIS" subsection. The diagnosis tells the circuit or area the problem may be in and possibly even the actual component causing it.
2. Once you have the circuit that is causing the trouble, read the "TROUBLESHOOTING" subsection to learn the procedure for finding the bad part.
3. Next, go to the schematic section and find the schematic that matches your monitor. It may be helpful to read the "DIFFERENCES BETWEEN MONITORS" subsection if you are unsure of which monitor you have. Use the schematic to see what parts are in the offending circuit.

That really is all there is to it. Just remember that there are some bizarre or rare symptoms not covered, or that a monitor may have two or more different problems that only a genius, the experienced, or an experienced genius can figure out. But be patient, follow safety precautions, and remember that there is also literature available from the monitor companies through your distributor or from Bally Midway Manufacturing Company on request. (There is a toll free number on the back side of the front cover of this manual.)

Symptom Diagnosis

1. Insufficient width or height:

- A. Horizontal line (due to VERTICAL CIRCUIT DEFECT).
 - ☐ Bad yoke.
 - ☐ Bad vertical output section.
 - ☐ Open fusible resistor in vertical section.
 - ☐ Bad height control.
 - ☐ Bad flyback.
- B. Vertical line (due to HORIZONTAL CIRCUIT DEFECT).
 - ☐ Bad yoke.
 - ☐ Open width coil.
 - ☐ Open part in horizontal output section.

2. Picture spread out too far or crushed in certain areas:

- A. Horizontal or vertical output transistor.
- B. Bad Component in output circuitry.
- C. Vertical linearity or damper control needs adjustment.

3. Line too close with black spacing:

- A. Problem in vertical section causing poor linearity.

4. Poor focus and convergence:

- A. Bad high voltage transformer ("flyback") or control.
- B. Focus voltage wire not connected to neck-board terminal.

5. Colors missing; check:

- A. Interface color transistors.
- B. Color output transistors.
- C. Cracked printed circuit board (neck Board).
- D. Color circuits.
- E. Video input jack.
- F. Defective picture tube.

6. Picture not bright enough:

- A. Weak emission from picture tube.

7. Silvery effect in white areas; check:

- A. Beam current transistors.
- B. Weak picture tube emission.

8. Too much brightness with retrace lines; check:

- A. Beam limiter transistors.
- B. Brightness and/or color blanking control set too high.

9. Increasing brightness causes an increase in size and poor focus.

- A. Weak high voltage rectifier or regulation (high voltage unit).
- B. Bad component in monitor's power supply.

10. Small picture and/or poor focus:

- A. Low B+ voltage (power supply trouble).

11. Vertical rolling:

- A. Vertical oscillator in the IC, vertical sync. transistor, or circuit.
- B. No sync from logic board.
- C. Three pin sync. jack is loose or plugged in wrong.

12. Horizontal line across center:

- A. Vertical output circuit is dead (see symptom No. 1. A.).
- B. Vertical oscillator is not putting out the right wave form.

13. Picture bends:

- A. Horizontal sync needs adjusting.
- B. Magnetic or electromagnetic interference.

14. Flashing picture, visible retrace lines:

- A. Broken neck board.
- B. Internal short circuit in the picture tube (arcing).

15. Unsymmetrical picture or sides of picture:

- A. Defective yoke.

16. No brightness, power supply operating — No high voltage for the picture tube; check:

- A. Horizontal oscillator.
- B. Horizontal amplifier and output.
- C. Flyback transformer (high voltage unit).

17. No brightness, high voltage present; check:

- A. Heater voltage to the tube at the neck board.
- B. Screen-grid voltage for the tube.
- C. Focus voltage.
- D. Grid to cathode picture tube bias.

18. No high voltage; check:

- A. For AC input to the "flyback".
- B. Horizontal deflection stages.
- C. Flyback transformer.
- D. Yoke.
- E. Power supply.

19. No horizontal and vertical hold; check:

- A. Sync transistors and circuit.
- B. Wires and jack from logic board to the monitor.

20. Wavy picture — (power supply defect); check:

- A. Transistors, diodes, electrolytic capacitors in the power supply.

21. Moving bars in picture:

- A. Ground connector off between monitor and logic boards.
- B. Defect in the power supply (see wavy picture symptom).

22. Washed out picture (see picture not bright enough):

- A. Check video signal at the cathode pins with an oscilloscope. If there is about 80 volts peak to peak, the picture tube has weak emission.

23. Monitor won't turn on:

- A. Problem in the power supply: Check fuse, transistors, open fusible resistor.
- B. Shorted horizontal output transistor.

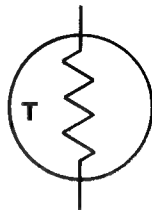
- C. Defective high voltage disabling circuit.

- D. Crack(s) somewhere on main chassis board.

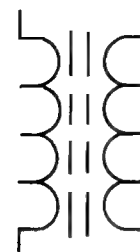
24. Can't adjust purity or convergence:

- A. Use a degausser to demagnetize the picture tube carefully following your degausser's instructions.
- B. Picture tube defective.
- C. Nearby equipment is electromagnetically interfering.
- D. The poles of the earth are pulling off the purity — see "A" above.
- E. Poor focus or width of picture.
- F. Make sure you have the correct CRT number for that brand of monitor.

Guide To Schematic Symbols



THERMISTOR
(POLARITY DOESN'T MATTER)



IRON CORE TRANSFORMER
(SUCH AS A FLYBACK)



INDUCTOR, COIL, CHOK
(POLARITY DOESN'T MATTER)



FUSE
(POLARITY DOESN'T MATTER)



(-) CATHODE

(+) ANODE

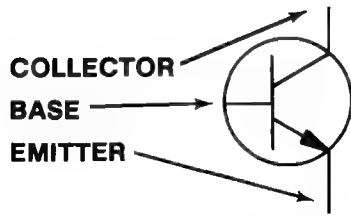
ZENER DIODE

CATHODE (-)

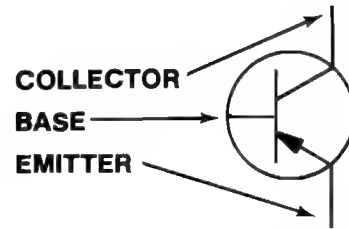


ANODE (+)

DIODE



NPN TRANSISTOR



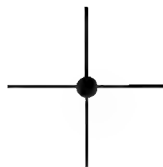
PNP TRANSISTOR



VARIABLE RESISTOR, POT, CONTROL
(POLARITY DOESN'T MATTER)



RESISTOR
(POLARITY DOESN'T MATTER)



LINES ARE CONNECTED



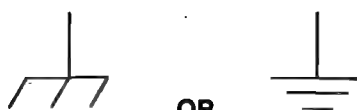
ELECTROLYTIC CAPACITOR



LINES ARE NOT CONNECTED



CAPACITOR
(POLARITY DOESN'T MATTER)



GROUND

Troubleshooting

Troubleshooting monitors requires experience, patience, **and luck**. The first step is to match the symptom the monitor displays to the diagnosis next to it in the "SYMPTOM-DIAGNOSIS" subsection. This will pinpoint the circuit the problem is probably in, and often the parts to check. Next, the circuit should be visually inspected to see if there are any parts broken, burned, or if something is there that shouldn't be, like a loose screw, etc. Some parts go bad before others and should be checked first. In fact, following is the general order in which parts usually go bad:

1. Semiconductors (like transistors, diodes, and integrated circuits).
2. Fusible resistors.
3. Electrolytic capacitors.
4. Resistors.
5. Capacitors and coils.

Always remember that a monitor can bite like a snake. Even when it is turned off, capacitors hold voltage and will discharge it to you should you be touching chassis ground. The picture tube or CRT, itself, is a giant capacitor, so avoid the flyback anode plug hole. With the monitor on, the power supply circuit and/or the flyback, which puts out at least 23,000 volts, **CAN BE KILLERS!!** Avoid handling power transistors (usually output transistors) or ICs, yoke terminals, and other high power components when the monitor is on.

WARNING: That picture tube is a bomb!

When it breaks, first it implodes, then it explodes. Large pieces of glass have been known to fly in excess of 20 feet in all directions. **DO NOT** carry it by the long, thin neck. Discharge its voltage to ground by shorting the anode hole to ground. Use a plastic handled screwdriver, connect one end of a wire with an alligator clip at each end to chassis ground and the other end to the metal shaft of the screwdriver. Using **ONE HAND ONLY** (put the other in your pocket) and touching **ONLY** the plastic handle of the screwdriver (**DO NOT TOUCH THE METAL SHAFT**) stick the blade of the screwdriver into the anode hole.

IMPORTANT! The side brackets of the monitor are chassis ground as is the aquadag, the picture tube's dark conductive coating. **BUT**, on the ZENITH MONITOR there are metallic mounting parts which **ARE NOT** chassis ground. Discharging the CRT to these will damage the monitor!

Be prepared for a fairly loud pop and a flash. The longer the monitor has been turned off, the smaller the pop and dimmer the flash. But **BE CAREFUL**, picture tubes will hold a very healthy charge for at least **a week** if not longer. Even after you've discharged it once, it may still carry a residual charge. It's better to be too careful than dead, which is why electronic equipment always carries stickers referring servicing to qualified personnel. Handle the side with the viewing screen against your chest when changing it. **ALWAYS** wear safety goggles when handling the picture tube.

To maintain the safety and performance of the monitor, always use exact replacement parts. For instance, the wrong components in the power supply can cause a fire, or the wrong color transistor may give a funny color to the picture. Service your monitor on a nonconductive firm table like wood, **NOT METAL**, and take off all of your jewelry just in case. With all this in mind, you are ready to begin troubleshooting.

Observe the picture carefully. Try to vary the appropriate control that would most likely affect your particular symptom. For example, if there is poor brightness or no picture, try turning up the brightness or contrast control. If the controls have no effect at all, chances are there is trouble with the control itself, the circuit it controls, or a nearby circuit that may be upsetting voltages. Go to the list of symptoms and determine with the schematic where the bad circuit is.

CAUTION:

Keep in mind that capacitors hold a charge as can the picture tube (for at least a week and usually longer), and could shock you.

First, check for obvious visual defects such as broken or frayed wires, solder where it is not supposed to be, missing components, burned components, or cracked printed circuit boards. If everything looks good up to this point, make sure that diodes, electrolytic capacitors, and transistors have their leads connected in the right polarity as shown on the schematic and the circuit board.

Turn on the power and measure the voltages at the leads of the active devices such as tubes, transistors, or integrated circuits. Any voltage that does not come within at least 10% to 15% of the voltage specified on the schematic indicates either a problem with that device or a component connected with it in the circuit. The next step is to use the ohmmeter to narrow down the field of possible offenders.

To test a transistor, one lead of the ohmmeter is placed on the base; and the other lead placed just on the emitter, then on the collector. A normal transistor will read either high resistance (infinite), or little resistance (400 to 900 ohms), depending on the polarity of this type transistor. Then the leads should be switched, one remaining on the base, and the other switched from the emitter to the collector. Now the opposite condition should result: the resistance should be infinite if it was lower when the other lead was on the base. Consistently infinite readings indicate an open, and a short is demonstrated by 0-30 ohms on most of these test readings. Finally, place one lead on the collector, then the other on the emitter. No matter which lead is used, there should be infinite resistance. Any lower reading, such as 50 ohms (which is typical on a bad transistor), indicates a short.

This all sounds pretty confusing, but a little experience on a good transistor will make you an expert in no time. Usually, the lowest ohmmeter setting is used for testing transistors. Once in a great while a transistor may check out good on this test, but may actually be "leaky" or break down only on higher voltages. If in doubt, change it. It is also wise to check the transistor out of the circuit just in case some component in the circuit is affecting the ohmmeter reading.

A diode is tested like a transistor except it only has two leads. Again, there should be high resistance one

way and little resistance the other. If it tests bad, take one lead out of the circuit in case some component is messing up the ohmmeter reading.

NOTE: DO NOT leave soldering equipment on the leads too long since all semiconductors, especially integrated circuits, are easily destroyed by heat.

Without special equipment, integrated circuits are checked by verifying the proper DC voltage on the pins and the correct AC wave form using an oscilloscope. **BE CAREFUL:** Shorting their pins can easily destroy them.

Resistors are checked with an ohmmeter and should usually be within ten percent of the value stated on them and on the schematic. You may have to desolder one lead from the printed circuit board. If you wreck the foil on the board, carefully solder a small wire over the break to reconnect the conductive foil.

Capacitors are tricky. Their resistance goes up when checked with an ohmmeter which shows a charging action. As they suck up current from the meter, the voltage goes up and so does the resistance. If you are sure a particular circuit is giving you a problem and everything else checks out O.K., Electrolytic capacitors are prime suspects. Substitute a new one and keep your fingers crossed.

Theory of Operation

To understand what goes on inside the monitor, large general groups of circuits will be examined instead of laboriously analyzing the branches and small circuits that make up these groups. This will help avoid confusion and aid in a basic, concrete, knowledge of what makes up a monitor.

THE POWER SUPPLY —

The AC going to the monitor from the game transformer is just like the voltage and current from your wall outlet. It jumps up and down going positive and negative sixty times a second. But a monitor needs nice, smooth DC; direct current, not alternating. So diodes chop up the AC and a big electrolytic capacitor filters it out to make it even smoother. Since the monitor is a big piece of electronic equipment, with many circuits demanding a lot of power from the power supply, there are also zener diodes and transistors to help maintain a nice, constant, smooth voltage so that the monitor circuits don't jump around. And this is what happens when you see a wavy picture. There is AC creeping

through the power supply, so it must be malfunctioning. If the voltage from the power supply is too low, the other circuits will be starved for power and you may see a small, wavy picture, or none at all.

Some circuits receive voltages that are higher than what the power supply should put out. But they come from the flyback transformer which will be discussed later.

THE INTERFACE SECTION OF THE CHASSIS —

The interface section of the chassis is fairly easy to identify. It is right by the place where the video jack(s) from the logic board(s) plug into. There are sets of transistors that receive the separate red, green, blue, and sync information from the cables that come from the logic boards. The circuits jack up the voltage and match impedances, or in other words, prepare the logic board outputs for the circuits that will really amplify them for the output devices such as the yoke in the case of the sync, or the picture tube that shows the colors.

An interesting aside is that our sync is composite negative sync. That means two things:

1. The sync is a negative going wave form.
2. There are two pulses going at different speeds over the same wire:
 - a. Vertical wave forms at 60 times per second (or Hertz) and
 - b. Horizontal wave forms at about 15,750 times per second (Hz).

The sync is amplified by a sync amplifier transistor and sent on its way to the oscillators. The sync or timing information will be explained along with the oscillator shortly.

The color information is sent via wires to the neck board where the main amplification occurs. This will also be discussed later.

VERTICAL AND HORIZONTAL DEFLECTION—

After the sync signal is amplified by the sync amp, it goes to two different sections, the vertical and horizontal circuits. Basically, the sync signals are for timing so the picture doesn't mess up since it is assembled like an orderly jigsaw puzzle, but so fast that you can't see the electron beams for each color painting the picture on the screen. This will all become clear soon. For now, we will follow the 60 cycle component of the sync as it goes on its journey to the deflection yoke.

The 60 cycle pulse goes to the vertical oscillator to make sure this circuit goes back and forth (or oscillates) at 60 times a second. Without this pulse keeping the circuit at the correct speed, it may get lazy and oscillate at 58 cycles or lower, or get ambitious and oscillate at 62 cycles or higher. At the wrong speed, the picture will start to roll up or down.

A Wells Gardner 13" (K4806) or 19" (K4906, K4956) color monitor uses an integrated circuit for its sync section. An Electrohome 13" or 19" color monitor uses an integrated circuit IC501 for its sync section. The Zenith monitor (CD19MXRF06) also uses an IC for the sync processing. Wells Gardner uses HA11423, Electrohome uses HA11244, and Zenith uses 221-175 (their part number). **These ARE NOT interchangeable!** The idea is all the same. The output to the vertical amplifying transistors for all monitors must form a sawtooth wave form, sort of like a bunch of pyramids, racing through the yoke's vertical coils at 60 times a second.

Along the way to the output transistors, the 60 cycle pulse is shaped and amplified to do the job: the yoke magnetically pushes the electron beam to fill the screen out sideways looking at the screen with the greatest length going up and down. Or viewing the screen sitting like a home television set, the amplified vertical output fills the screen up and down. Watching a monitor like this, seeing only a horizontal line means a problem with the vertical coils of the yoke or

anything from the vertical output section on back to the oscillator.

The horizontal section is very similar with a few exceptions. The horizontal wave shape is more like a square and has a frequency of 15,750 cycles a second. Both Wells Gardner and Electrohome use the other side of their respective integrated circuits for the horizontal circuitry. If the oscillator isn't going at the correct speed, the picture may move sideways, start to slant, or tear up with slanted thin figures. With both the vertical and horizontal of all monitors, there are variable resistors that change the speed of the oscillators up and down. This way you have controls that can make the correct frequencies to keep the electronic jigsaw puzzle nicely locked in place. If you're driving in a car and next to you someone else is driving their car at exactly the same speed, it will appear that they are not moving. And this is why the sync frequency and the oscillator's frequency must match, so the picture doesn't appear to move.

The correct wave form is shaped and amplified in the circuitry just like in the vertical section. But the horizontal output transistor is a large power transistor and not only serves to give current to the horizontal yoke windings, it also feeds the flyback transformer.

THE FLYBACK TRANSFORMER (OR HIGH VOLTAGE UNIT) —

The picture tube needs high voltage to light up, and the power supply can't meet this demand. The flyback transformer receives current alternating at about 15,750 times per second from the horizontal output transistor. The "flyback" jacks up its input voltage and puts out a higher voltage alternating at the same speed. But, in your "flyback" there are diodes that chop up the alternating voltage to make it a smooth DC output just like in the power supply. This is what goes through that thick red wire to your picture tube. **THIS AREA HAS ABOUT 24,000 VOLTS ON IT AND IT CAN KILL YOU!!**

The "flyback" may be dangerous, but it is also generous. It has extra output windings which give voltage to the heater pins of the picture tube, voltage for the vertical deflection circuits, and picture tube screen-grid voltage. So in a way, the high voltage "flyback" is like a second power supply.

COLOR CIRCUITS —

The color circuits are pretty straight forward. The signals go into the interface section where some amplification and impedance matching occurs. These circuits are pretty sparse and simple. Each color just has two transistors and a diode with some resistors and capacitors. From here, the AC color signal is sent by wires to the neck board.

The color output circuits are on the neck board. The color signals going to the transistors are controlled by two variable resistors called drive controls. There are only two, one for the red and one for the green on

Wells Gardner and Electrohome monitors. Zenith monitors have all three: red, blue and green.

The Wells Gardner and Electrohome monitor have another variable resistor in their emitter part of their color output transistors. These "cutoff controls" vary the amount of A.C. signal that the transistor amplifies and sends to the cathodes of the picture tube. The Zenith monitor has its cutoff controls in the interface section to vary the amount of signal going to the output transistors. The more signal, the more color.

If you think this is confusing, here is another little hitch. The Electrohome and Zenith monitors both have the actual A.C. picture information signal going through the emitters of the color output transistors. The Wells Gardner has the A.C. signal going to the base of the transistors. The blanking and beam limiting signals which come from the blanking and beam limiting transistors in the interface section go into the color output transistor base in the Electrohome and Zenith monitors, but enters into the emitter of the Wells Gardner monitor's color output transistor. Should you feel adventurous enough to look at this signal on an oscilloscope, it should look like a square.

The beam limiter helps control the brightness level, and the blanking transistor rapidly turns the picture tube on and off so that retrace lines don't show up on the screen. By turning up the brightness on a good monitor, these four to six retrace lines can be seen slanting diagonally across the picture.

PROTECTION CIRCUIT —

To protect the high voltage section against voltages that are too high coming from the power supply which could cause X-rays to be emitted from the "flyback", a circuit senses the higher power supply voltage and turns off the horizontal oscillator. Since the horizontal oscillator doesn't work, the horizontal output transistor has nothing to feed the "flyback" which in turn has nothing to feed the picture tube. The monitor will be silent, have no picture, and will appear to be off. **But don't be fooled.** There is still that excessive amount of voltage coming from the power supply. To find out, check at pin two of Wells Gardner's IC501 and emitter of X04 for the Electrohome monitor. Check the 95 volt test point (located near the "flyback") for the Zenith monitor. The Wells Gardner monitor doesn't use this circuit, but an open in the horizontal section could cause the monitor to appear off, yet still have power supply voltage flying around. Here are the voltages you should receive:

Wells Gardner	=	130VDC
Electrohome	=	120VDC
Zenith	=	95VDC

The best place to measure this voltage on an Electrohome monitor is at a pin marked B1 on the chassis. This is because a 13 inch color Electrohome monitor, The G07-FB0 or G07-902, has an integrated circuit and very little else in the power supply. Still, there should be 120VDC at B1.

THE PICTURE TUBE (OR CRT) —

ATTENTION! For information on picture tube replacement types, go to the last section, "PICTURE TUBE INTERCHANGEABILITY".

The picture tube or CRT is an output device. In other words, the end result of the circuit's work is displayed by this part. Actually, the output of other circuits is in the neck of the picture tube.

First, there is the heater. The heater boils off electrons from the cathodes so that they (the electrons) shoot up to the screen to excite the phosphors so that the three phosphors emit three colors of light.

The cathodes are next, and again they emit electrons to turn on the tube phosphors, making it glow. A defective cathode may cause the particular color it handles to be missing.

Next come the grids. The first grid is grounded. The following grid is the screen grid which receives about 300VDC depending on the brightness setting. The next grid closest to the picture tube screen is the focus grid which gets about one fifth the amount of voltage that is applied to the picture tube anode.

After jetting from the cathode through all these grids, the electrons speed through a mask, a sheet of material with tiny holes, and then excite the tiny dots of phosphor in the inside surface of the picture tube screen. The green electron gun (or cathode and circuitry) spits out electrons which head for the green phosphors only. The same goes for the red and blue guns. The way the phosphor light blends determines the color seen. Should these electron beams become too intense, they may burn the phosphor. With the monitor off, this can be seen as a dark permanent image of the video information on the tube screen.

Differences Between Monitors

The easiest way to identify the brand of monitor you are working with is to find the manufacturer's name or model number printed on the chassis or chassis base. But what if the monitor was in a Texas dust storm or buried in volcanic ash and this information is no longer there? Fear not! Each monitor has its own peculiarities and the following should help to identify them:

The **ELECTROHOME** G07-904 (19") and G07-902 (13") have their horizontal and vertical processing IC hidden under a silver can. A shiny metal top behind the "VERTICAL HEIGHT" and "HORIZONTAL FREQUENCY" control prove this is an Electrohome monitor.

The **WELLS GARDNER** K4906 (19") and K4806 (13") have their horizontal and vertical processing IC out in the open directly behind the "VERTICAL HOLD" control.

The **ZENITH** C019MXRF06 (19") monitor has its horizontal and vertical processing IC way in back by the picture tube. The monitor also has large white cables going from the main board to the neck board.

K4906 (1st TYPE) — This monitor's identifying tags have **BLACK** ink printed on a white background. There is **NO** Vertical Damping Control. (This Control would be next to the Vertical Hold Control but this area is jumpered with a small wire instead.

K4906 (2nd TYPE) — This monitor's identifying tags have **RED** ink printed on a white background. There **IS** a Vertical Damping Control next to the Vertical Hold Control. The Damping Control provides a few more lines on the top of the monitor screen (monitor viewed as a normal T.V. would be) for any video game that may need these lines to fit the picture on the screen. Moving the Control may distort the top part of your picture (or the side, depending on the game and how the monitor is mounted) so go ahead and move it if you are having this type of problem. To accommodate this new feature, there are a few circuit changes.

ONE MAJOR DIFFERENCE BETWEEN THESE TWO VERSIONS OF THE K4906 IS THE YOKE. They look the same but notice the part numbers:

K4906 **WITHOUT** the Damper Control: 2021111201

K4906 **WITH** the Damper Control: 2021111258

Since the companies like to change part numbers at the drop of a hat, the best thing to do is to request whatever part number is written on your yoke. If you should get the wrong yoke, the results will be:

Picture distortion.

Excessive brightness.

Too much or too little vertical picture size.

CONTROLS YOU MAY NOT TOUCH

Basically, on the Electrohome monitor, you can move any control you want **EXCEPT** for the B1 control. This sets the power supply voltage (ideally at 120 VDC) and is located right behind VERTICAL HOLD. The 13" Electrohome **DOES NOT** have this control. It may also be wise not to move the VERTICAL LINEARITY since this distorts the picture and is hard to reset perfectly. If you do move it, turn on the Cross Hatch Test Pattern of your game and try to get the squares to the point where they are equal in size by readjusting this Linearity Control.

On the Wells Gardner monitor, brightness is adjusted by the "BLACK LEVEL" Control which is right next to the Horizontal Frequency Control. Under the Focus Control is the "SCREEN" Control which you **DO NOT** touch. Yes, this control does adjust the brightness,

but it is used to set the CRT bias and is adjusted at the factory. When Wells Gardner sets it, they mark the position with a black mark on the knob. If you move it, be sure to realign the mark and **THEN** set the BLACK LEVEL Control to the brightness you desire. So, other than the SCREEN control, you may adjust any of the controls.

The Zenith monitor has a 95 volt adjustment control. It is green and located behind the jack labeled 3D3. To discourage you from moving it, Zenith has placed a little glue on top of this control.

Parts Interchangeability

Some parts can be interchanged on all of the monitors. Here are the rules:

1. You **CAN** swap any resistor between monitors that has the same resistance, wattage rating, and tolerance.
2. You **CAN** swap any capacitor between monitors that has the same capacitance and voltage rating.
3. You **CAN** swap many of the parts between the 19" and the 13" versions of each manufacturer's monitor. **BUT**, be certain to compare the manufacturers' part numbers to be positive the parts you want to interchange are identical. **BE SURE** you have read the section DIFFERENCES BETWEEN MONITORS which was covered earlier.
4. You **MAY BE ABLE** to swap picture tubes between monitors. In the past you could swap any picture tube, but due to rampant engineering changes and new monitor models being introduced, you would need a computer to keep track of what could be swapped. For more information on this subject, go to "PICTURE TUBE INTERCHANGEABILITY".
5. You **CANNOT** change any part that is a **safety part**, one that is shaded in gray on the schematic; it **MUST** be **IDENTICAL** to the original. **To do otherwise IS DANGEROUS.** For instance, the 13 inch Electrohome (G07-902) monitor "flyback" looks identical to the 19 inch Electrohome (G07-904) monitor "flyback". In fact, there is even a 19 inch Electrohome (G07-905) monitor (which is an obsolete model) with a similar looking "flyback". **NONE OF THESE ARE INTERCHANGEABLE!!**
6. You **CAN** change any of the parts between the G07-904 and G07-907. They're essentially the same monitor except that the G07-907 has a vertically mounted picture tube.

If there is any doubt about what parts can be swapped between each manufacturer's 19 inch and 13 inch models, compare the manufacturer's part number between each one. If they match up, they are the same part.

Picture Tube Interchangeability

13" MONITORS

There are currently two 13" monitors being used: the Wells Gardner K4806 and the Electrohome G07-902. The picture tubes used are NOT interchangeable. The pins on the neck of the CRT will not fit in the socket should you use the wrong CRT.

Here is a chart for all the 13" color monitors Bally Midway uses.

ELECTROHOME	G07-902	— 370ESB22
WELLS GARDNER	K4806	— 370KSB22

The factory recommended CRT type could change in the future for one reason or another, but the listed picture tubes will work. As a matter of fact, you can call another picture tube company to see if they have a replacement number to recommend...but caveat emptor — let the buyer beware.

19" MONITORS

Here it gets a little tricky. All of the picture tubes will fit no matter which is used. But if you use the wrong one, you will have problems with purity and/or dynamic convergence.

Purity trouble means that the color won't be true. If you turn up the color control for one color, instead of seeing that solid color it will show blotches or blobs of other colors on the screen.

Trouble with dynamic convergence means that there will be color fringing around solid lines at the edges of the screen.

The only way to ensure that you avoid these problems is to get the right picture tube or the right substitute.

Here is a list of the 19" monitors and the **CORRECT** CRT numbers.

ALL ELECTROHOME G07-904 —
19VMNP22 RCA
19VMJP22 RAULAND
510UJB22 HITACHI

WELLS GARDNER K4906 —
19VLTP22 RCA
19VMLP22 ZENITH
19VMKP22 PHILLIPS

ZENITH CD19MXRF06 —
19VMLP22 ZENITH
19VLTP22 RCA
19VMKP22 PHILLIPS

Notes

**Monitor
Schematics**

19" COLOR MONITOR SCHEMATIC DIAGRAM
MODELS 19K4901, 19K4906, 19K4951, 19K4956

Power Supply Voltage and Symbols

Symbol	Voltage	Operating Circuit
	15V	Vert. Osc. Sync Blanking CRT Cut-Off
	130V	Horiz. Osc. Horz. Drive Horz. Output Vert. Output
	175V	Video Output

SERVICE TECHNICIAN WARNING
X-RAY RADIATION PRECAUTION:

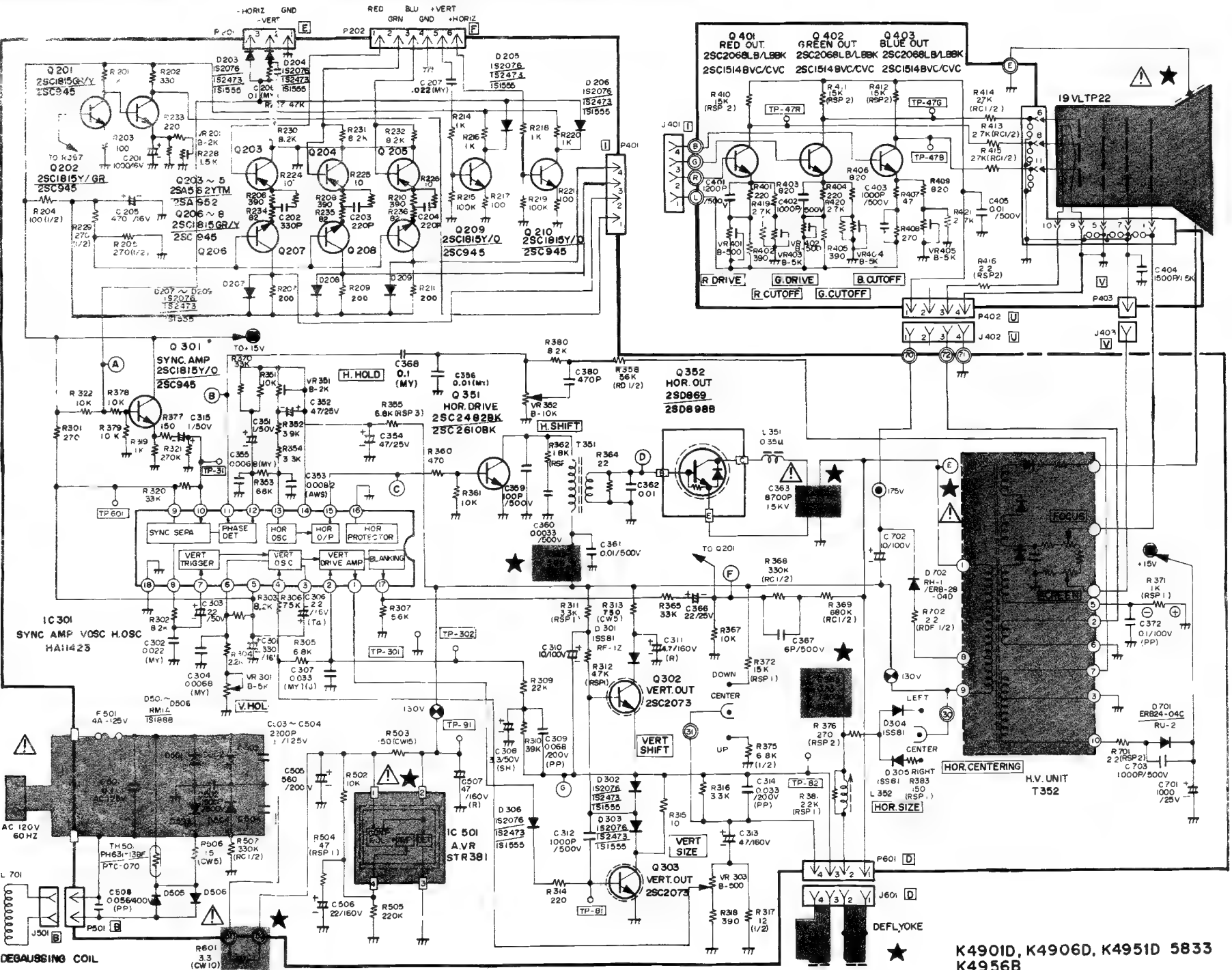
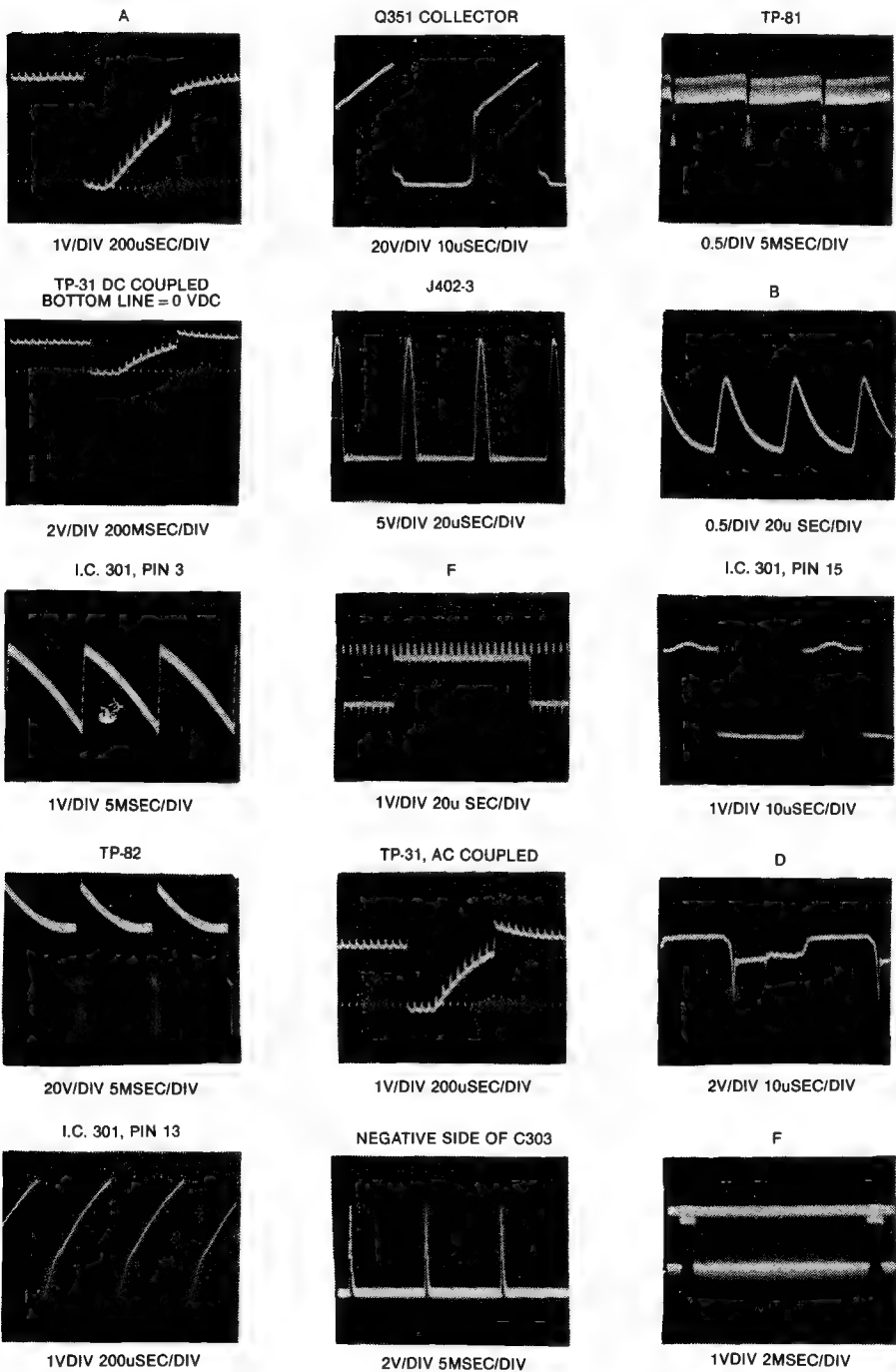
THIS PRODUCT CONTAINS CRITICAL ELECTRICAL AND MECHANICAL PARTS ESSENTIAL FOR X-RAY RADIATION PROTECTION.
FOR REPLACEMENT PURPOSES, USE ONLY TYPE PARTS SHOWN IN THE PARTS LIST.

CAUTION: FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.
AVERTISSEMENT: POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT.

OSCILLOSCOPE WAVEFORM PATTERN

The waveforms shown are as observed on the wide band oscilloscope with the monitor turned to a reasonably strong signal and a normal picture. The voltages shown on each waveform are the approximate peak amplitudes.

If the waveforms are observed on the oscilloscope with a poor high frequency response, the corner of the pulses will tend to be more rounded than those shown and the amplitude of any high frequency pulse will tend to be less.



K4901D, K4906D, K4951D 5833
K4956B

REPLACEMENT PARTS LIST

This monitor contains circuits and components included specifically for safety purposes.

For continued protection no changes should be made to the original design, and components shown in shaded areas of schematic, or **▲ ★** on parts list should be replaced with exact factory replacement parts.

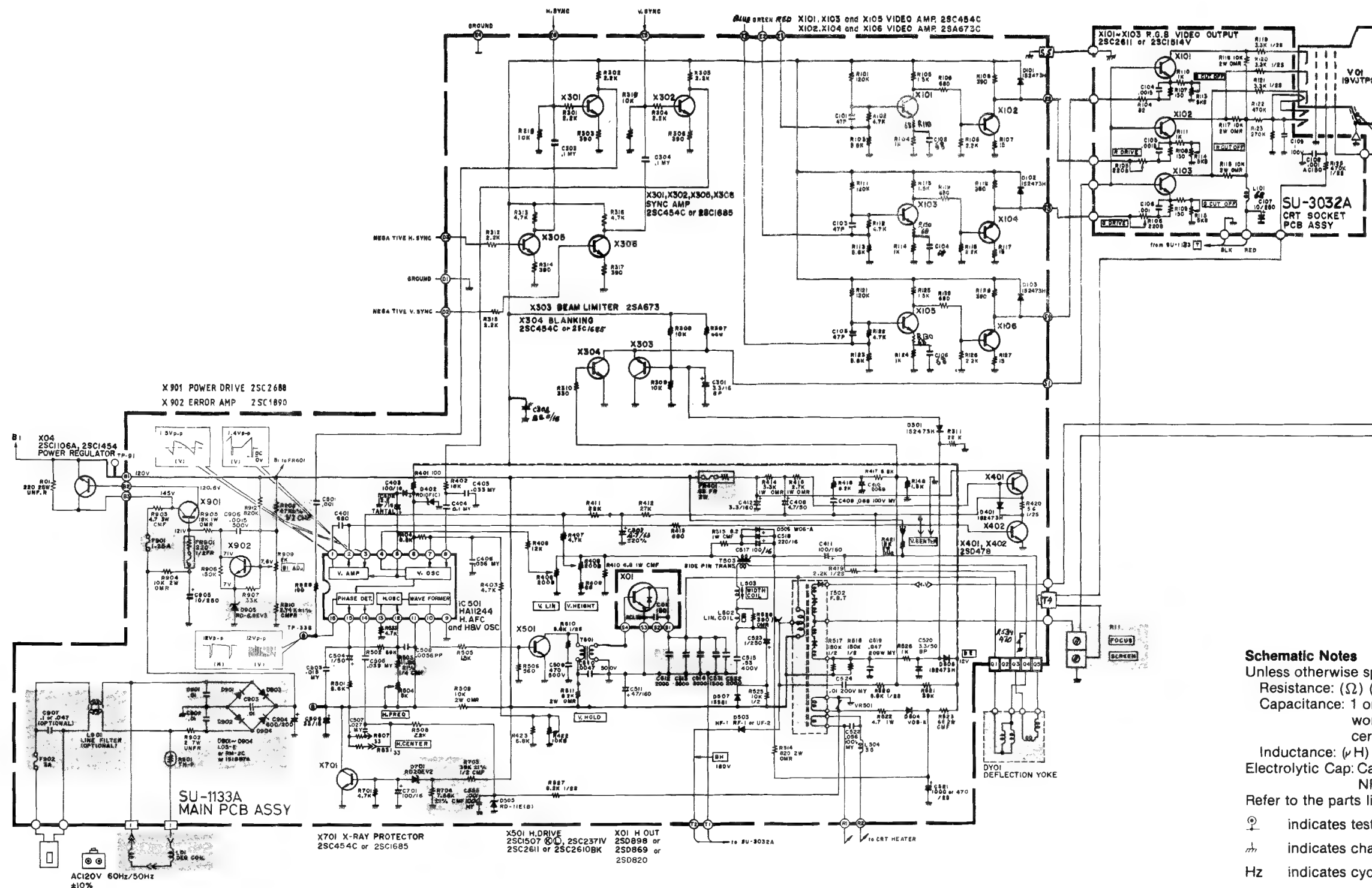
The use of substitute parts may create a shock, fire, radiation or other hazard. Service should be performed by qualified personnel only.

MAIN BOARD

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
RESISTORS			RESISTORS (CONT.)		
R201	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R369	203X5602-329	680K Ohm, 5%, 1/2W Comp.
R202	203X6500-523	30 Ohm, 5%, 1/4W Carbon	R370	203X6501-002	33K Ohm, 5%, 1/4W Carbon
R203	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R371	203X9014-584	1K Ohm, 5%, 1W Metal Oxide
R204	203X6700-327	100 Ohm, 5%, 1/2W Carbon	R372	203X9101-119	12K Ohm, 5%, 1W Metal Oxide
R205	203X6700-421	270 Ohm, 5%, 1/2W Carbon	R375	203X6700-763	6.8K Ohm, 5%, 1/2W Carbon
R206	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R376	203X9104-404	270 Ohm, 5%, 2W Metal Oxide
R207	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R377	203X6500-447	150 Ohm, 5%, 1/4W Carbon
R208	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R378	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R209	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R379	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R210	203X6500-540	390 Ohm, 5%, 1/4W Carbon	R380	203X6500-865	8.2K Ohm, 5%, 1/4W Carbon
R211	340X2201-934	200 Ohm, 5%, 1/4W Carbon	R381	203X6500-724	2.2K Ohm, 5%, 1W Metal Oxide
R214	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R383	203X9014-387	150 Ohm, 5%, 1W Metal Oxide
R215	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R502	203X6500-886	10K Ohm, 5%, 1/4W Carbon
R216	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R503	204X1700-535	150 Ohm, 5%, 15W Metal Oxide
R217	203X6500-405	100 Ohm, 5%, 1/4W Carbon	R504	203X9014-267	47 Ohm, 5%, 1W Metal Oxide
R218	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R505	203X6501-209	2.2K Ohm, 5%, 1/4W Carbon
R219	203X6501-126	100K Ohm, 5%, 1/4W Carbon	R506	203X9104-105	15 Ohm, 5%, 2W Metal Oxide
R220	203X6500-645	1K Ohm, 5%, 1/4W Carbon	R507	203X5602-185	330K Ohm, 5%, 1/2W Comp.
R221	203X6500-405	100 Ohm, 5%, 1/4W Carbon	▲★R601	204X1625-058	3.3 Ohm, 5%, 10W WW
R222	203X6500-762	3.3 Ohm, 5%, 1/4W Carbon	R701	203X9105-141	2.2 Ohm, 5%, 2W Metal Oxide
R224	203X6500-169	10 Ohm, 5%, 1/4W Carbon	R702	203X6206-441	2.2 Ohm, 5%, 1/2W Carbon
R225	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR201	204X2070-072	2K Ohm-B Semi-Fixed
R226	203X6500-169	10 Ohm, 5%, 1/4W Carbon	VR301	204X2070-084	5K Ohm-B Semi-Fixed
R227	203X6501-044	47K Ohm, 5%, 1/4W Carbon	VR303	204X2070-055	500 Ohm-B Semi-Fixed
R228	203X6500-645	1K Ohm, 5%, 1/4W Carbon	VR351	204X2070-072	2K Ohm-B Semi-Fixed
R229	203X6700-421	270 Ohm, 5%, 1/2W Carbon	VR352	204X2070-072	2K Ohm-B Semi-Fixed
R230	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	CAPACITORS		
R231	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	C201	203X0014-088	1000 uF, 16V, Electrolytic
R232	203X6500-863	8.2K Ohm, 5%, 1/2W Comp.	C202	202X7200-064	330 pF, 500V, Ceramic
R233	203X6500-468	180 Ohm, 5%, 1/4W Carbon	C203	202X7200-043	220 pF, 500V, Ceramic
R234	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C204	202X7200-043	220 pF, 500V, Ceramic
R235	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C205	203X0014-076	470 uF, 16V, Electrolytic
R236	340X2820-934	82 Ohm, 5%, 1/4W Carbon	C206	203X1810-149	0.1 uF, 125V Mylar
R301	203X6500-508	270 Ohm, 5%, 1/4W Carbon	C207	349X2232-109	.022 uF, 100V Mylar
R302	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C301	203X0014-065	330 uF, 50V Electrolytic
R303	203X6500-863	8.2K Ohm, 5%, 1/4W Carbon	C302	203X1600-563	0.033 uF, 50V Mylar
R304	203X6500-724	2.2K Ohm, 5%, 1/4W Carbon	C303	203X0629-037	3.3 uF, 50V Electrolytic
R305	203X6500-842	6.8K Ohm, 5%, 1/4W Carbon	C304	203X1600-366	0.068 pF, 50V Mylar
R306	203X6003-201	7.5K Ohm, 2%, 1/4W Carbon	C306	203X0412-012	2.2 uF, 16V Tantal
R307	203X6500-825	5.6K Ohm, 5%, 1/4W Carbon	C307	203X1600-634	0.033 uF, 50V Mylar
R309	203X6500-965	22K Ohm, 5%, 1/4W Carbon	C308	203X0025-174	3.3 uF, 50V Electrolytic
R310	203X6500-988	39K Ohm, 5%, 1/4W Carbon	C309	203X1207-100	0.068 uF, 100V PP
R311	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C310	203X0629-061	10 uF, 100V Electrolytic
R312	203X9014-741	4.7K Ohm, 5%, 1/4W Carbon	C311	203X0041-025	10 uF, 160V Electrolytic
R313	204X1450-537	1K Ohm, 5%, 5W Carbon	C312	202X7050-248	1000 pF, 500V Ceramic
R314	203X6500-481	220 Ohm, 5%, 1/4W Carbon	C313	203X0040-052	47 uF, 160V Electrolytic
R315	203X6500-169	10 Ohm, 5%, 1/4W Carbon	C314	203X1201-265	0.033 uF, 200V PP
R316	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C315	203X0629-023	1 uF, 50V Electrolytic
R317	203X6700-107	12 Ohm, 5%, 1/2W Carbon	C351	203X0629-023	1 uF, 50V Electrolytic
R318	203X6500-540	390 Ohm, 5%, 1/4W Carbon	C352	203X0619-045	47 uF, 25V Electrolytic
R319	203X6500-645	1K Ohm, 5%, 1/4W Carbon	C353	203X1190-015	0.0082 pF, 50V Mylar-PP
R320	203X6501-002	33K Ohm, 5%, 1/4W Carbon	C354	203X0619-045	47 uF, 25V Electrolytic
R321	203X6501-224	270K Ohm, 5%, 1/2W Carbon	C355	203X1600-366	0.0068 pF, 50V Mylar
R322	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C356	202X7050-483	0.01 uF, 500V Ceramic
R351	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C359	202X8065-606	100 pF, 500V Ceramic
R352	203X6500-785	3.9K Ohm, 5%, 1/4W Carbon	C360	202X7050-366	0.0033 pF, 500V Ceramic
R353	203X6501-088	68K Ohm, 5%, 1/4W Carbon	C361	202X7050-483	0.01 uF, 500V Ceramic
R354	203X6500-762	3.3K Ohm, 5%, 1/4W Carbon	C362	202X7203-032	0.01 uF, 50V Ceramic
R355	203X9205-143	6.8K Ohm, 5%, 3W Metal Oxide	▲★C363	203X1270-911	8700 pF, 1.5 KV PP
R358	203X5601-878	56K Ohm, 5%, 1/2W Carbon	★C365	203X1201-265	0.33 uF, 200V PP
R360	203X6500-561	470 Ohm, 5%, 1/4W Carbon	C366	203X0019-026	22 uF, 25V Electrolytic
R361	203X6500-886	10K Ohm, 5%, 1/4W Carbon	C367	202X8065-162	6 pF, 500V Ceramic
R362	203X9014-645	1.8K Ohm, 5%, 1W Metal Oxide	C368	202X7203-032	0.01 uF, 50V Ceramic
★R363	204X1527-751	3.9K Ohm, 5%, 7W Metal Oxide	C372	203X1207-125	0.1 uF, 100V PP
R364	203X6500-246	22 Ohm, 5%, 1/4W Carbon			
R365	203X6501-002	33K Ohm, 5%, 1/4W Carbon			
R367	203X6500-886	10K Ohm, 5%, 1/4W Carbon			
R368	203X5602-185	330K Ohm, 5%, 1/2W Comp.			

MAIN BOARD (CONT.)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
CAPACITORS (CONT.)			SEMICONDUCTORS (CONT.)		
C380	202X7200-087	470 uF, 500V Ceramic	Q206	200X3181-523	Transistor (NPN) 2SC1815GR
▲C501	203X1810-149	0.1 uF, 125V Mylar	Q207	200X3181-523	Transistor (NPN) 2SC1815GR
▲C502	202X7050-282	1500 pF, 500V Ceramic	Q208	200X3181-523	Transistor (NPN) 2SC1815GR
▲C503	202X7810-214	2200 pF, 125V Ceramic	Q209	200X3181-523	Transistor (NPN) 2SC1851GR
▲C504	202X7810-214	2200 pF, 125V Ceramic	Q210	200X3181-523	Transistor (NPN) 2SC1851GR
C505	203X0220-075	560 uF, 200V Electrolytic	Q301	200X3181-523	Transistor (NPN) 2SC1851GR
C506	203X0040-034	22 uF, 160V Electrolytic	Q302	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C507	203X0041-057	47 uF, 160V Electrolytic	Q303	200X3207-306	Transistor (NPN) 2SC2073LBGL2
C701	203X0019-092	1000 uF, 25V Electrolytic	Q351	200X3248-217	Transistor (NPN) 2SC2482BK
C702	203X0634-061	10 uF, 100V Electrolytic	Q352	200X4589-802	Transistor (NPN) 2SD898B
C703	202X7050-248	1000 pF, 500V Ceramic	IC301	200X2300-033	IC HA11423
			▲★IC501	200X2600-183	IC STR381
SEMICONDUCTORS			TRANSFORMERS & COILS		
D203	201X2010-159	Diode, IS2076-27			
D204	201X2010-159	Diode, IS2076-27	L351	201X4710-134	Coil, (RF Choke)
D205	201X2010-159	Diode, IS2076-27	L352	201X5000-083	Coil, Horiz. Size
D206	201X2010-159	Diode, IS2076-27	L701	611X0004-007	Coil, Adg.
D207	201X2010-159	Diode, IS2076-27	T351	202X1300-080	Transformer, Hor. Drive
D208	201X2010-159	Diode, IS2076-27	▲★T352	200X9720-301	HV-Unit M-11
D209	201X2010-159	Diode, IS2076-27			
D301	201X2010-165	Diode, ISS81	MISCELLANEOUS		
D302	201X2010-159	Diode, IS2076-27	▲F501	204X7120-073	Fuse, 4 Amp. 125V
D303	201X2010-159	Diode, IS2076-27	J402	206X5008-632	Recep W Wire 3P-M-BG
D304	201X2120-009	Diode, RH-IV	P201	204X9600-466	Plug, PWB 3P-J
D305	201X2120-009	Diode, RH-IV	P202	204X9601-477	Plug, PWB 6P-Q
D306	201X2010-159	Diode, IS2076-27	P401	204X9600-298	Plug, PWB 4P-B
▲D501	201X3120-216	Diode, RM-1AV	P501	204X9600-249	Plug, PWB 2P-B
▲D502	201X3120-216	Diode, RM-1AV	P601	204X9600-304	Plug, PWB 4P-C
▲D503	201X3120-216	Diode, RM-1AV	TH501	201X0100-112	Thermistor
▲D504	201X3120-216	Diode, RM-1AV			
D505	201X3120-216	Diode, RM-1AV			
D506	201X3120-216	Diode, RM-1AV			
D701	201X2130-234	Diode, RU-2V			
D702	201X2120-009	Diode, RH-1V			
Q201	200X3181-523	Transistor (NPN) 2SC1815GR			
Q202	200X3181-523	Transistor (NPN) 2SC1815GR			
Q203	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q204	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
Q205	200X4056-260	Transistor (PNP) 2SA562-Y-TM			
NECK BOARD			CAPACITORS		
R401	203X6000-729	220 Ohm, 5% 1/4W Carbon	C401	202X7050-269	1200 pF, 500V Ceramic
R402	203X6500-540	390 Ohm, 5% 1/4W Carbon	C402	202X7050-248	1000 pF, 500V Ceramic
R403	203X6000-661	820 Ohm, 5% 1/4W Carbon	C403	202X7050-248	1000 pF, 500V Ceramic
R404	203X6000-729	220 Ohm, 5% 1/4W Carbon	C404	202X7050-282	1500 pF, 1.5KV Ceramic
R405	203X6500-540	390 Ohm, 5% 1/4W Carbon	C405	202X7050-483	0.01 uF, 500V Ceramic
R406	203X6000-661	820 Ohm, 5% 1/4W Carbon			
R407	203X6000-729	470 Ohm, 5% 1/4W Carbon			
R408	203X6000-998	270 Ohm, 5% 1/4W Carbon			
R409	203X6000-661	820 Ohm, 5% 1/4W Carbon	Q401	200X3206-800	Transistor (NPN) 2SC2068LB
R410	203X9104-824	15K Ohm, 5% 2W M.O. Forming	Q402	200X3206-800	Transistor (NPN) 2SC2068LB
R411	203X9104-824	15K Ohm, 5% 2W M.O. Forming	Q403	200X3206-800	Transistor (NPN) 2SC2068LB
R412	203X9104-824	15K Ohm, 5% 2W M.O. Forming			
R413	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R414	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R415	203X6000-998	2.7K Ohm, 5% 1/2W Comp.			
R416	203X9105-154	2.2 Ohm, 5% 2W Metal Oxide	J401	206X5009-296	RECEP W Wire 4P-E
R419	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P402	204X9600-254	Plug, PWB 3P-A
R420	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P403	204X9600-981	Plug, Pin 1P-D
R421	203X6500-741	2.7K Ohm, 5% 1/4W Carbon	P701	204X9601-020	Plug, PWB 4P-E
VR401	204X2115-014	500 Ohm, -B Semi-Fixed			
VR402	204X2115-014	500 Ohm, -B Semi-Fixed			
VR403	204X2115-006	5K Ohm, -B Semi-Fixed			
VR404	204X2115-006	5K Ohm, -B Semi-Fixed			
VR405	204X2115-006	5K Ohm, -B Semi-Fixed			




Schematic Notes

Unless otherwise specified
Resistance: (Ω) (K \rightarrow K Ω , M \rightarrow M Ω), 1/4 (W) carbon resistor
Capacitance: 1 or higher \rightarrow (pF), less than 1 \rightarrow (μ F)
working voltage \rightarrow 50 (V)
ceramic capacitor

Inductance: (μ H)
Electrolytic Cap: Capacitance Value (μ F)/working voltage (V),
NP \rightarrow non-polar (or bipolar) electrolytic cap.
Refer to the parts list for additional component information.

\odot indicates test point connection
 \perp indicates chassis ground unless otherwise specified
Hz indicates cycles per second

For **safety** purposes (and continuing reliability)
 \triangle replace all components marked with safety symbol with identical type.
NOTE: FR \rightarrow fusible resistor (\rightarrow )

Parts identification on circuit boards:
e.g. SU1126A (R107 = R1107)
SU3030A (R113 = R3113)

00-4147-04
G07-CB0

REPLACEMENT PARTS LIST—ELECTROHOME 19" MONITOR

Components identified by the Δ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap.	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap.	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

SERVICE REPLACEMENT PARTS LIST

Symbol	Description	Part Number
	Main P.C.B. Ass'y	SU-1133A
	CRT Socket P.C.B. Ass'y	SU-3032A
	Purity Shield Ass'y	07-220083-03

Outside of the P.C.B. Ass'y

Symbol	Description	Part Number
	Picture Tube 19"	17-7198-03
Δ	ΔDeflection Yoke	A29779-D=21-141-01
	PC Magnet	A75034-B=29-32-01
Δ	ΔFlyback Transf.	A29951-B
Δ	ΔHVR	A46600-A
R05	UNF Resistor 220Ω,25W K	QRF258K-221
C04	C Capacitor 150pF, AC1.5KV	QCZ0101-005
X01	Si. Transistor	2SD870
X02	Si. Transistor	2SC1106A
SC	Screw #8-¾	31-610818-06
SC	Screw ¼ x ¾ Pix Tube Mtg. (4)	31-601418-12
WA	Pyramidal Lock Washer (4)	33-255-01
	Nut Retainer, Pix Tube Mtg. (4)	33-494-01
	Clip—P.C.B. Support	33-629-02
	Standoff	33-670-010R-02
	Wire Terminal (Gnd. Strap)	34-228-03
	Terminal Lug (Gnd.)	34-33-04
	Groundstrap Assy.	34-574-02
	Grounding Spring	35-212-03
	Wire Hook (Gnd. Strap)	35-3053-02
	Purity Shield Holddown Clamp	35-2348-01
	Support Brkt. RH	35-3890-01
	Support Brkt. LH	35-3890-02
	Chassis Base	38-449-02
	Yoke Wedge (3)	39-1233-01

Purity Shield Ass'y. Parts List

Symbol	Description	Part Number
	Degaussing Coil	21-1007-30
D911,	Rectifier 1 Amp 600V (2)	28-22-27
D912	Pin Terminal (2)	34-708-01
	Pin Terminal Housing	34-709-01
	Purity Shield (2 pcs.)	35-3847-01
	Purity Shield (2 pcs.)	35-3847-02
C911	Capacitor 100nF 10% 400V	48-171544-62
R921	Resistor, Wirewound 33Ω, 4W	42-113301-03
	Fire Retardant Term. Strip 4 Lug	34-492-09

CRT Socket P.C.B. Ass'y (SU-3032A) Parts List

Resistors			Part Number
Symbol	Description		
R3105	V	R 200	QVZ3234-022
R3106	V	R 200	QVZ3234-022
R3113	V	R 5K	QVZ3234-053
R3114	V	R 5K	QVZ3234-053
R3115	V	R 5K	QVZ3234-053
R3116	OM	R 10KΩ2W J	QRG029J-103
R3117	OM	R 10KΩ2W J	QRG029J-103
R3118	OM	R 10KΩ2W J	QRG029J-103
R3119	Comp. R	3.3KΩ½W K	QRZ0039-332
R3120	Comp. R	3.3KΩ½W K	QRZ0039-332
R3121	Comp. R	3.3KΩ½W K	QRZ0039-332
Capacitors			Part Number
Symbol	Description		
C3107	E	Cap. 10uF 250V A	QEW53EA-106
C3108	C	Cap. 1000pF DC1400V P	QCZ9001-102M

CRT Socket P.C.B. Ass'y (SU-3032A) Parts List (Cont.)

Colls Symbol	Description	Part Number
L3101	Peaking Coil	QQL043K-101
Semi-conductors		
Symbol	Description	Part Number
X3101	Si. Transistor	2SC1514VC
X3102	Si. Transistor	2SC1514VC
X3103	Si. Transistor	2SC1514VC
Miscellaneous		
Symbol	Description	Part Number
Δ	ΔCRT Socket	A76068

Main PCB Ass'y (SU-1133A) Parts List

Resistors Symbol	Description	Part Number
R1406	V R 200Ω	QVZ3230-002
R1408	V R 200Ω	QVZ3230-002
R1410	CMF R 6.8Ω1W J	QRX019J-6R8
R1414	OM R 3.3KΩ1W J	QRG019J-332
R1415	OM R 2.7KΩ1W J	QRG019J-272
R1421	OM R 12KΩ2W J	QRG026J-123Z
R1422	V R 10KΩ	QVZ3230-014
ΔFR1401	ΔF R 68Ω2W K	QRH024K-680M
ΔR1503	ΔCMF R 11.8KΩ¼W+1%	QRV142F-1182
R1504	V R 5KΩ	QVZ3230-053
R1509	OM R 10KΩ2W J	QRG026J-103Z
R1512	OM R 8.2KΩ2W J	QRG026J-822Z
R1514	OM R 820Ω2W J	QRG026J-821Z
R1515	CMF R 8.2Ω1W J	QRX019J-8R2
R1522	CMF R 4.7Ω1W J	QRX019J-4R7
R1523	OM R 68Ω2W J	QRG026J-680Z
R1528	OM R 390Ω1W J	QRG019J-391
R1534	ZN R	ERZ-C05ZK471
VR1501	ZN R	ERZ-C05ZK271
ΔR1703	ΔCMF R 39Ω½W+1%	QRV122F-3902
ΔR1704	ΔCMF R 7.68KΩ¼W+1%	QRV142F-7681
ΔR1901	ΔPosistor	A75414
R1902	UNF R 2Ω7W K	QRF076K-2R0
R1903	CMF R 4.7Ω3W J	QRX039J-4R7
R1904	OM R 10KΩ2W J	QRG026J-103Z
R1905	OM R 18KΩ1W J	QRG019J-183
ΔQ1908	ΔCMF R 47Ω½W+1%	QRV122F-470Z
ΔR1909	V R 2KΩ	QVP5A0B-023E
R1910	ΔCMF R 2.74KΩ¼W+1%	QRV142F-274I
ΔFR1901	ΔF R 220Ω½W K	QRH124K-221M

Capacitors Symbol	Description	Part Number
C1301	BPE Cap. 3.3uF 50V A	QEN61HA-335Z
C1402	Tan Cap. 2.2uF 16V K	QEE51CK-225B
C1407	E Cap. 4.7uF 6.3V A	QEW51JA-475
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600uF 50V J	QFP31HJ-562
ΔC1512	ΔPP Cap. 2000pF DC1500V J	QFZ0082-202
ΔC1513	ΔPP Cap. 2000pF DC1500V J	QFZ0082-202
ΔC1514	ΔPP Cap. 2000pF DC1500V J	QFZ0082-202
C1515	PP Cap. 0.53uF DC1200V J	QFZ0067-534
C1520	BPE Cap. 3.3uF 50V A	QEN61HA-335Z
C1523	E Cap. 1uF 160V A	QEW62CA-105Z
C1524	M Cap. 0.1uF 200V K	QFM720K-104M
ΔC1531	ΔPP Cap. 2000pF DC1500V J	QFZ0082-202
ΔC1532	ΔPP Cap. 1500pF DC1500V J	QFZ0082-152
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106

Main PCB Ass'y (SU-1133A) Parts List (Cont.)

Colls Symbol	Description	Part Number
L1502	Linarity Coil	A39835
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30445-A
Transformers		
Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A
Semi-conductors		
Symbol	Description	Part Number
IC1501	IC	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1901	Si. Transistor	2SC2688 (K.L.M.)
X1902	Si. Transistor	2SC1890A (E.F.)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1SZ473H
D1401	Si. Diode	1SZ473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1SZ473H
ΔD1701	ΔZener Diode	RD20EV2
ΔD1901	ΔSi. Diode	1S1887A
ΔD1902	ΔSi. Diode	1S1887A
ΔD1903	ΔSi. Diode	1S1887A
ΔD1904	ΔSi. Diode	1S1887A
ΔD1905	ΔZener Diode	RD6.8EV3
Miscellaneous		
Symbol	Description	Part Number
ΔF1901	ΔFuse 1.25A	QMF53U1-1R25S
ΔF1902	ΔUL Fuse 3A	QMF66U1-3R0S



REPLACEMENT PARTS LIST—ELECTROHOME 13" MONITOR

Components identified by the Δ symbol in the PARTS LIST and on the Schematic have special characteristics important to safety.

DO NOT degrade the safety of the set through improper servicing.

Abbreviations for Resistors and Capacitors

Resistor		Capacitor	
C R	: Carbon Resistor	C Cap.	: Ceramic Capacitor
Comp. R	: Composition Resistor	M Cap.	: Mylar Capacitor
OM R	: Oxide Metal Film Resistor	E Cap.	: Electrolytic Capacitor
V R	: Variable Resistor	BP E Cap.	: Bi-Polar (or Non-Polar) Electrolytic Capacitor
MF R	: Metal Film Resistor	MM Cap.	: Metalized Mylar Capacitor
CMF R	: Coating Metal Film Resistor	PP Cap.	: Polypropylene Capacitor
UNF R	: Nonflammable Resistor	MPP Cap.	: Metalized PP Capacitor
F R	: Fusible Resistor	PS Cap.	: Polystyrol Capacitor
		Tan. Cap.	: Tantal Capacitor

NOTE: When ordering replacement parts please specify the part number as shown in this list including part name, and model number. Complete information will help expedite the order.

Use of substitute replacement parts which do not have the same safety characteristics as specified, may create shock, fire or other hazards. For maximum reliability and performance, all parts should be replaced by those having identical specifications.

SERVICE REPLACEMENT PARTS LIST

			Main P.C.B. Ass'y (SU-1103A) Parts List		
Symbol	Description	Part Number	Resistors		
	Main P.C.B. Ass'y	SU-1103A	Symbol	Description	Part Number
	CRT Socket P.C.B. Ass'y	SU-3016A	R1406	V R 200 Ω	QVZ3230-022
Outside of the P.C.B. Ass'y			R1408	V R 200 Ω	QVZ3230-022
Δ V01	Δ Picture Tube 13"	370ESB22(E)	R1410	CMF R 6.8 Ω 1W J	QRX019J-6R8
Δ DY01	Δ Deflection Yoke	C29123-V	R1414	OM R 3.3K Ω 1W J	QRG019J-332
	PC Magnet	A76366-A	R1415	OM R 2.7K Ω 1W J	QRG019J-272
	Wedge	C30006	R1421	OM R 12K Ω 2W J	QRG029J-123
	Δ Flyback Transf.	A19183-A	R1422	V R 10K Ω	QVZ3224-014H
Δ R11	Δ Focus V R	A46606-A	Δ FR1401	Δ F R 68 Ω 2W K	QRH024K-680M
Δ R05	UNF Resistor 220 Ω ,25W. K	QRF258K-221	Δ R1503	Δ CMF R 11.8 Ω $\frac{1}{2}$ W +1%	QRV142F-1182
Δ C04	Δ C Capacitor 150pF, A C1.5KV	QCZ0101-005	R1504	V R 5K Ω	QVZ3230-053
X01	Si. Transistor	2SD869	R1509	OM R 10K Ω 2W J	QRG029J-103
IC01	IC Regulator	STR383	R1511	OM R 5.6K Ω 2W J	QRG029J-562
L01	Degaussing Coil	21-1007-31	R1514	OM R 680 Ω 2W J	QRG029J-681
	Degaussing Coil Pin Terminal	34-708-01	R1515	CMF R 8.2 Ω 1W J	QRX019J-8R2
	Degaussing Coil Pin Terminal Housing	34-709-01	R1522	CMF R 4.7 Ω 1W J	QRX019J-4R7
	Groundstrap Ass'y	34-697-04	R1523	OM R 56 Ω 2W J	ORG029J-560
	Groundstrap Wire Terminal	34-228-03	R1528	OM R 390 Ω 1W J	ORG019J-391
	Groundstrap Spring (2)	35-3560-01	R1534	ZN R	ERZ-C05ZK471
BR	Support Bracket RH	35-3919-01	VR1501	ZN R	ERZ-C05DK271
BR	Support Bracket LH	35-3919-02	Δ R1703	Δ CMF R 39K Ω $\frac{1}{2}$ W +1%	QRV122F-3902
SC	SCREW 10- $\frac{1}{2}$ Pix Tube Mtg. (4)	31-631018-08	Δ R1704	Δ CMF R 7.68K Ω $\frac{1}{4}$ W +1%	QRV142F-7681
WA	Pyramidal Lockwasher (4)	33-255-01	Δ R1901	Δ Posistor	A75414
	Clip P.C.B. Support (2)	33-629-02	R1902	UNF R 2 Ω 7W K	QRF076K-2R0
	Ground Lug	34-33-04	R1903	CMF R 5.6 Ω 3W J	QRX039J-5R6
CH	Chassis Base	38-452-01	R1904	OM R 10K Ω 2W J	QRG026J-103Z
			Δ FR1901	Δ F R 220 Ω $\frac{1}{2}$ W K	QRH124K-221M

Main P.C.B. Ass'y (SU-1103A) Parts List

Capacitors		
Symbol	Description	Part Number
C1402	Tan. Cap. 2.2uF 16V K	QEE51CK-225B
C1411	E Cap. 100uF 160V A	QEW52CA-107
C1412	E Cap. 3.3uF 160V A	QEW52CA-335
C1508	PP Cap. 5600pF 50V J	QFP31HJ-562
C1511	E Cap. 47uF 160V A	QEW52CA-476S
Δ C1512	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1513	Δ PP Cap. 2000pF DC1500V J	QFZ0082-202
Δ C1514	Δ PP Cap. 2500pF DC1500V J	QFZ0082-252
C1515	PP Cap. 0.53uF DC1200V K	QFZ0067-534
C1520	BPE Cap. 1uF 50V A	QEN61HA-105Z
C1524	M Cap. 0.1uF 200V K	QFM72DK-682M
C1904	E Cap.	QEY0034-001
C1905	E Cap. 10uF 250V A	QEW52EA-106
Δ C1907	Δ MM Cap. 0.1uF AC150V Z	QFZ9008-104

Coils		
Symbol	Description	Part Number
L1501	Peaking Coil	A75360-6
L1502	Liniarty Coil	A39934
L1503	Width Coil	C30380-A
L1504	Heater Choke	C30333-A
L1901	Line Filter	A39475-J

Transformers		
Symbol	Description	Part Number
T1501	Hor. Drive Transf.	A46022-BM
T1503	Side Pin Transf.	C39050-A

Semi-conductors		
Symbol	Description	Part Number
IC1501	I.C.	HA11244
X1101	Si. Transistor	2SC1685(R)
X1102	Si. Transistor	2SA673(C)
X1103	Si. Transistor	2SC1685(R)
X1104	Si. Transistor	2SA673(C)
X1105	Si. Transistor	2SC1685(R)
X1106	Si. Transistor	2SA673(C)
X1301	Si. Transistor	2SC1685(R)
X1302	Si. Transistor	2SC1685(R)
X1303	Si. Transistor	2SA673(C)
X1304	Si. Transistor	2SC1685(R)
X1305	Si. Transistor	2SC1685(R)
X1401	Si. Transistor	2SD478
X1402	Si. Transistor	2SD478
X1501	Si. Transistor	2SC2610BK
X1701	Si. Transistor	2SC1685(P-S)
D1101	Si. Diode	W06A
D1102	Si. Diode	W06A
D1103	Si. Diode	W06A
D1301	Si. Diode	1S2473H
D1401	Si. Diode	1S2473H
D1402	Zener Diode	RD10F(C)
D1503	Si. Diode	HF-1
D1504	Si. Diode	V09E
D1505	Zener Diode	RD11E(B)
D1506	Si. Diode	W06A
D1507	Si. Diode	1SS81
D1508	Si. Diode	1S2473H
Δ D1701	Δ Zener Diode	D20EV2
Δ D1901	Δ Si. Diode	1S1887A
Δ D1902	Δ Si. Diode	1S1887A
Δ D1903	Δ Si. Diode	1S1887A
Δ D1904	Δ Si. Diode	1S1887A

Miscellaneous		
Symbol	Description	Part Number
Δ F1901	Δ Fuse 1A	QMF53U1-1R0S
Δ F1902	Δ UL Fuse 3A	QMF66U1-3R0S

CRT Socket P.C.B. Ass'y (SU-3016A) Parts List

Resistors		
Symbol	Description	Part Number
R3105	V R 200 Ω	QVZ3234-022
R3106	V R 200 Ω	QVZ3234-022
R3113	V R 5K Ω	QVZ3234-053
R3114	V R 5K Ω	QVZ3234-053
R3115	V R 5K Ω	QVZ3234-053
R3116	OM R 10K Ω 2W J	QRG029J-103
R3117	OM R 10K Ω 2W J	QRG029J-103
R3118	OM R 10K Ω 2W J	QRG029J-103
R3119	Comp. R 3.3K Ω $\frac{1}{2}$ W K	QRZ0039-332
R3120	Comp. R 3.3K Ω $\frac{1}{2}$ W K	QRZ0039-332
R3121	Comp. R 3.3K Ω $\frac{1}{2}$ W K	QRZ0039-332

Capacitors		
Symbol	Description	Part Number
C3107	E Cap. 10uF 250V A	QEW52EA-106
C3108	C Cap. 1000pF DC1400V P	QCZ9001-102M

Coils		
Symbol	Description	Part Number
L3101	Peaking coil	QQL043K-101

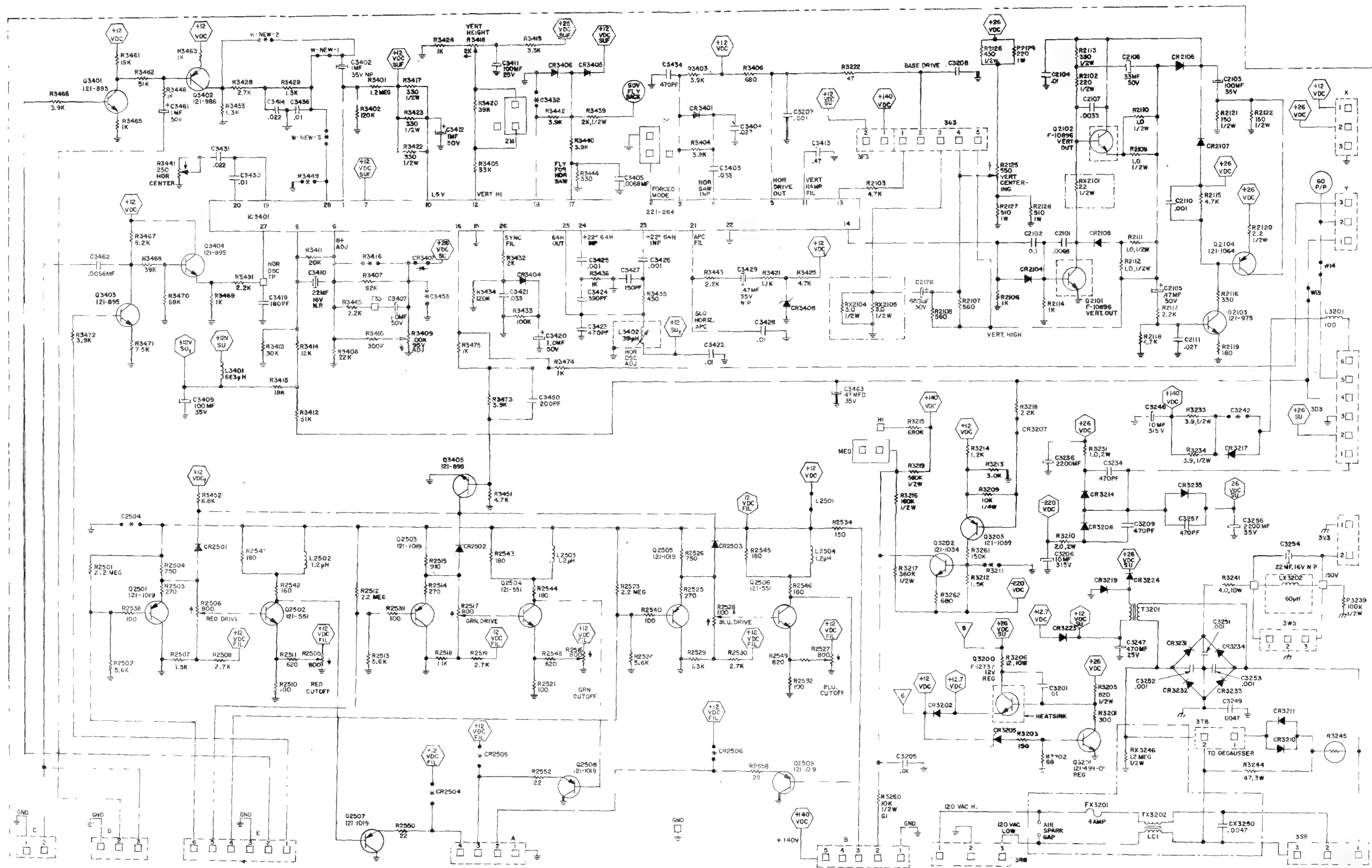
Semiconductors		
Symbol	Description	Part Number
X3101	Si. Transistor	2SC2611
X3102	Si. Transistor	2SC2611
X3103	Si. Transistor	2SC2611

Miscellaneous		
Symbol	Description	Part Number
Δ	CRT Socket	A75522

ZENITH MONITOR — SWEEP BOARD
REPLACEMENT PARTS LIST

SWEEP BOARD (9-186-03)

Ref. No.	Part No.	Description	Ref. No.	Part No.	Description
CAPACITORS			TRANSFORMERS & COILS		
C2131	22-7508	47 MF, 35V, ±20% Electrolytic	L3207	149-454	Core, Ferrite Bead
C2152	22-7508-01C	22 MF, 35V, ±20% Electrolytic	L3220	F-13834	Core & Sleeving Assy. (149-509-01)
C3201	22-7410-05	10 MF, 100V, ±20% Electrolytic	LX3261	20-3976	Coil Width
CX3202	22-7710-01C	1 MF, 50V, +50%–10% Electrolytic	LX3262	20-3975	Coil, Linearity, with 205-271 Hot Melt
C3203	22-7711-08C	47 MF, 63V, +50%–10% Electrolytic	T3205	95-3344	Transformer, Horizontal Driver
CX3204	22-7773-24A	0.1 MF, 100V, ±5% Polyester	TX3204	95-3581-01	Transformer, Sweep
CX3205	22-7523-01	0.01 MF, 2KV, ±20% Disc	RESISTORS		
C3206	22-7708-04C	4.7 MF, 25V, +50%–10% Electrolytic	R2105	63-9921-94	8.2K Ohm, ±5% 1/4W Film
C3207	22-5665	330 PF, 1000V, ±10% Disc	R2110	63-9921-64	470K Ohm, ±5% 1/4W Film
C3209	22-7242	0.0018 MF, 200V, ±10% Disc	R2111	63-9919-83	3K Ohm, ±2% 1/4W Film
C3211	22-7777-20B	0.047 MF, 200V, ±10% Polyester	R2112	63-9919-96	10K Ohm, ±2% 1/4W Film
C3212	22-7234	560 PF, 500V, ±10% Disc	RX3204	63-9921-80	2.2K Ohm, ±5% 1/4W Film
C3213	22-7775-16A	0.022 MF, 100V, ±20% Polyester	RX3206	63-7805	3.3K Ohm, ±5% 1/2W Carbon
C3214	22-7775-10A	0.0068 MF, 100V, ±20% Polyester	RX3207	63-9921-32	22 Ohm, ±5% 1/4W Film
C3216	22-5684	470 PF, 500V, ±20% Disc	RX3208	63-10235-80	2.2K Ohm, ±5% 1/4W Film
C3217	22-5684	470 PF, 500V, ±20% Disc	RX3209	63-10235-72	1K Ohm, ±5% 1/4W Film
C3218	22-7774-15C	0.018 MF, 100V, ±10% Polyester	RX3210	63-7805	3.3K Ohm, ±5% 1/2W Carbon
C3222	22-7742-10	0.001 MF, 50V, ±10% Axial	RX3211	63-10810-07	3K Ohm, ±1% 1/2W Film
CX3228	22-6466	530 PF, 3KV, ±10% Disc	RX3214	63-10233-81	2.4K Ohm, ±2% 1/4W Film
CX3229	22-7672-07	0.013 MF, 1.6KV, ±5% Polypropylene	RX3216	63-10810-06	1.2K Ohm, ±1% 1/2W Film
C3233	22-7728	0.68 MF, 200V, ±10% Polyester	RX3217	63-7760	270 Ohm, ±5% 1/2W Carbon
C3244	22-7566-24	0.1 MF, 250V, ±10% Polyester	RX3215	63-10235-98	12K Ohm, ±5% 1/4W Film
C3261	22-7683-01	0.68 MF, 200V, ±5% Polypropylene	RX3218	63-10235-82	2.7K Ohm, ±5% 1/4W Film
SEMICONDUCTORS			RX3219	63-10235-88	4.7K Ohm, ±5% 1/4W Film
CR3202	103-142-01	Diode, Low Voltage	R3224	63-9946-88	4.7K Ohm, ±5% 1/2W Film
CR3203	103-330A	Diode, Low Voltage	R3225	63-10836-68	680 Ohm, ±5% 2W Wire Wound
CRX3204	103-308A	Diode, Zener	R3226	63-10235-74	1.2K Ohm, ±5% 1/4W Film
CR3205	103-305	Diode, Damper	R3227	63-10235-80	2.2K Ohm, ±5% 1/4W Film
CR3206	103-284A	Diode, Low Voltage	RX3235	63-10810-06	1.2K Ohm, ±1% 1/2W Film
CR3207	103-295-01A	Diode, Low Voltage (used with 149-454)	RX3240	53-10657-04	10 Meg Ohm, ±20% 1/2W Carbon
CR3208	103-295-01A	Diode, Low Voltage	R3242	63-10243-80	2.2K Ohm, ±5% 1/2W Film
CR3209	103-142-01	Diode, Low Voltage	R3243	63-10243-80	2.2K Ohm, ±5% 1/2W Film
CR3210	103-142-01	Diode, Low Voltage	R3244	63-7868	100K Ohm, ±5% 1/2W Carbon
CR3211	103-142-01	Diode, Low Voltage	R3261	63-10444-86	390 Ohm, ±10% 5W Wire Wound
QX3202	121-975	Transistor, NPN	R3262	63-10565-65	510 Ohm, ±10% 1/2W Film
QX3204	121-973	Transistor, PNP, Shutdown	R3263	63-10565-65	510 Ohm, ±10% 1/2W Film
Q3206	121-1037	Transistor, NPN, Forward Driver	R3282	63-10235-96	10K Ohm, ±5% 1/4W Film
QX3207	121-975	Transistor, NPN, Shutdown			
Q3209	121-1040	Transistor, NPN, Reverse Driver			



SCHEMATIC FOR
9-227-01
RGB COLOR MONITOR
(MAIN BOARD)

ZENITH
RADIO CORP. C
CHICAGO, ILL

9-227

M051-00087-A024

ZENITH MONITOR — MAIN BOARD REPLACEMENT PARTS LIST

MAIN BOARD (Continued)

Board					Description
9-227	-01	Ref. No.	Part No.		
RESISTORS					
X	X	RX2101	63-10565-32	22 Ohm, ±5%, 1/2W Film	
X	X	R2102	63-10243-56	220 Ohm, ±5%, 1/2W Film	
X	X	R2103	63-10235-88	4.7K Ohm, ±5%, 1/2W Film	
X	X	RX2104	63-10243-11	3 Ohm, ±5%, 1/2W Film	
X	X	RX2105	63-10243-11	3 Ohm, ±5%, 1/2W Film	
X	X	R2106	63-10235-72	1K Ohm, ±5%, 1/4W Film	
X	X	R2107	63-10235-66	560 Ohm, ±5%, 1/4W Film	
X	X	R2108	63-10235-66	560 Ohm, ±5%, 1/4W Film	
X	X	R2109	63-10565	1 Ohm, ±5%, 1/2W Film	
X	X	R2110	63-10565	1 Ohm, ±5%, 1/2W Film	
X	X	R2111	63-10565	1 Ohm, ±5%, 1/2W Film	
X	X	R2112	63-10565	1 Ohm, ±5%, 1/2W Film	
X	X	R2113	63-10243-60	330 Ohm, ±5%, 1/2W Film	
X	X	R2114	63-10235-72	1K Ohm, ±5%, 1/4W Film	
X	X	R2115	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	
X	X	R2116	63-10235-60	330 Ohm, ±5%, 1/4W Film	
X	X	R2117	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
X	X	R2118	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	
X	X	R2119	63-10235-54	180 Ohm, ±5%, 1/4W Film	
X	X	R2120	63-10565-08	2.2 Ohm, ±5%, 1/2W Film	
X	X	R2121	63-10243-52	150 Ohm, ±5%, 1/2W Film	
X	X	R2122	63-10243-52	150 Ohm, ±5%, 1/2W Film	
X	X	R2125	63-9023-02	550 Ohm, ±20%, Control-Rotary Single-GRA	
	X	R2126	63-10243-66	560 Ohm, ±5%, 1/2W Film	
X		R2126	63-10243-53	160 Ohm, ±5%, 1/2W Film	
	X	R2127	63-10243-69	750 Ohm, ±5%, 1W Carbon	
X		R2128	63-10243-66	560 Ohm, ±5%, 1/2W Film	
	X	R2128	63-6058	510 Ohm, ±5%, 1W Carbon	
	X	R2129	63-10243-65	510 Ohm, ±5%, 1/2W Carbon	
X		R2501	63-10236-28	220K Ohm, ±5%, 1/4W Film	
	X	R2501	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film	
X	X	R2502	63-10235-90	5.6K Ohm, ±5%, 1/4W Film	
X		R2503	63-10235-56	220 Ohm, ±5%, 1/4W Film	
	X	R2503	63-10235-58	270 Ohm, ±5%, 1/4W Film	
X		R2504	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
	X	R2504	63-10235-69	750 Ohm, ±5%, 1/4W Film	
X		R2505	63-10857-11	5K Ohm, Control-Rotary Single-RED	
	X	R2505	63-10857-27	800 Ohm, Control-Rotary Single-Red Cut-Off	
X		R2506	63-10857-30	1K Ohm, Control-Rotary Single-Yellow	
	X	R2506	63-10857-27	800 Ohm, Control-Rotary Single-Red Drive	
X		R2507	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	
	X	R2507	63-10235-75	1.3K Ohm, ±5%, 1/4W Film	
	X	R2508	63-10235-93	7.5K Ohm, ±5%, 1/4W Film	
X		R2508	63-10235-82	2.7K Ohm, ±5%, 1/4W Film	
X		R2509	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
X		R2510	63-10235-50	120 Ohm, ±5%, 1/4W Film	
	X	R2510	63-10235-48	100 Ohm, ±5%, 1/4W Film	
X		R2511	63-10235-74	1.2K Ohm, ±5%, 1/4W Film	
	X	R2511	63-10235-67	620 Ohm, ±5%, 1/4W Film	
X		R2512	63-10236-28	220K Ohm, ±5%, 1/4W Film	
	X	R2512	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film	
X	X	R2513	63-10235-90	5.6K Ohm, ±5%, 1/4W Film	
X		R2514	63-10235-56	220 Ohm, ±5%, 1/4W Film	
	X	R2514	63-10235-58	270 Ohm, ±5%, 1/4W Film	
X		R2515	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
		R2515	63-10235-71	910 Ohm, ±5%, 1/4W Film	
X		R2516	63-10857-32	5K Ohm, Control-Rotary Single-Green	
	X	R2516	63-10857-25	800 Ohm, Control-Rotary Single-Green Cut-Off	
X		R2517	63-10857-30	1K Ohm, Control-Rotary Single-Yellow	
	X	R2517	63-10857-25	800 Ohm, Control-Rotary Single-Green Drive	
X		R2518	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	

Board				Description
9-227	-01	Ref. No.	Part No.	
RESISTORS (Continued)				
	X	R2518	63-10235-73	1.1K Ohm, ±5%, 1/4W Film
X		R2519	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
	X	R2519	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X		R2520	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R2521	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2521	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2522	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
X		R2523	63-10236-28	220K Ohm, ±5%, 1/4W Film
	X	R2523	63-10236-52	2.2 Meg Ohm, ±5%, 1/4W Film
X	X	R2524	63-10235-90	5.6K Ohm, ±5%, 1/4W Film
X		R2525	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2525	63-10235-58	270 Ohm, ±5%, 1/4W Film
X		R2526	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R2526	63-10235-69	750 Ohm, ±5%, 1/4W Film
X		R2527	63-10857-31	5K Ohm, Control-Rotary Single-Blue
	X	R2527	63-10857-26	800 Ohm, Control-Rotary Single-Blue Cut-Off
X		R2528	63-10857-30	1K Ohm, Control-Rotary Single-Yellow
	X	R2528	63-10857-26	800 Ohm, Control-Rotary Single-Blue Drive
X		R2529	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
	X	R2529	63-10235-75	1.3K Ohm, ±5%, 1/4W Film
X		R2530	63-10235-93	7.5K Ohm, ±5%, 1/4W Film
	X	R2530	63-10235-82	2.7K Ohm, ±5%, 1/4W Film
X		R2531	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
X		R2532	63-10235-50	120 Ohm, ±5%, 1/4W Film
	X	R2532	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2533	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
		R2534	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2535	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2536	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2537	63-10235-52	150 Ohm, ±5%, 1/4W Film
X		R2538	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2538	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2539	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2539	63-10235-48	100 Ohm, ±5%, 1/4W Film
X		R2540	63-10235-56	220 Ohm, ±5%, 1/4W Film
	X	R2540	63-10235-48	100 Ohm, ±5%, 1/4W Film
	X	R2541	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2542	63-10235-53	160 Ohm, ±5%, 1/4W Film
	X	R2543	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2544	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2545	63-10235-54	180 Ohm, ±5%, 1/4W Film
	X	R2546	63-10235-53	160 Ohm, ±5%, 1/4W Film
	X	R2548	63-10235-67	620 Ohm, ±5%, 1/4W Film
	X	R2549	63-10235-67	620 Ohm, ±5%, 1/4W Film
	X	R2550	63-10235-32	22 Ohm, ±5%, 1/4W Film
	X	R2552	63-10235-32	22 Ohm, ±5%, 1/4W Film
	X	R2554	63-10235-32	22 Ohm, ±5%, 1/4W Film
X		R3201	63-10235-59	300 Ohm, ±5%, 1/4W Film
X		R3202	63-10235-44	68 Ohm, ±5%, 1/4W Film
X		R3203	63-10235-52	150 Ohm, ±5%, 1/4W Film
X	X	R3205	63-7781	820 Ohm, ±5%, 1/2W Carbon
X		R3206	F-11851	12 Ohm, ±10%, 10W Resistor & Splice Assy.
	X	R3206	63-10460-50	12 Ohm, ±10%, 10W Wirewound
X	X	R3210	63-10420-31	2 Ohm, ±5%, 2W Wirewound
X	X	R3212	63-10235-76	1.5K Ohm, ±5%, 1/4W Film
X		R3213	63-10235-83	3K Ohm, ±5%, 1/4W Film
	X	R3213	63-10235-86	3.9K Ohm, ±5%, 1/4W Film
X	X	R3214	63-10235-74	1.2K Ohm, ±5%, 1/4W Film
	X	R3215	63-10244-38	560K Ohm, ±5%, 1/2W Film
	X	R3215	63-10244-40	680K Ohm, ±5%, 1/2W Film
X	X	R3216	63-10244-25	160K Ohm, ±5%, 1/2W Film
X	X	R3217	63-10244-33	360K Ohm, ±5%, 1/2W Film
X	X	R3218	63-10235-80	2.2K Ohm, ±5%, 1/4W Film
	X	R3219	63-10244-38	560K Ohm, ±5%, 1/2W Film

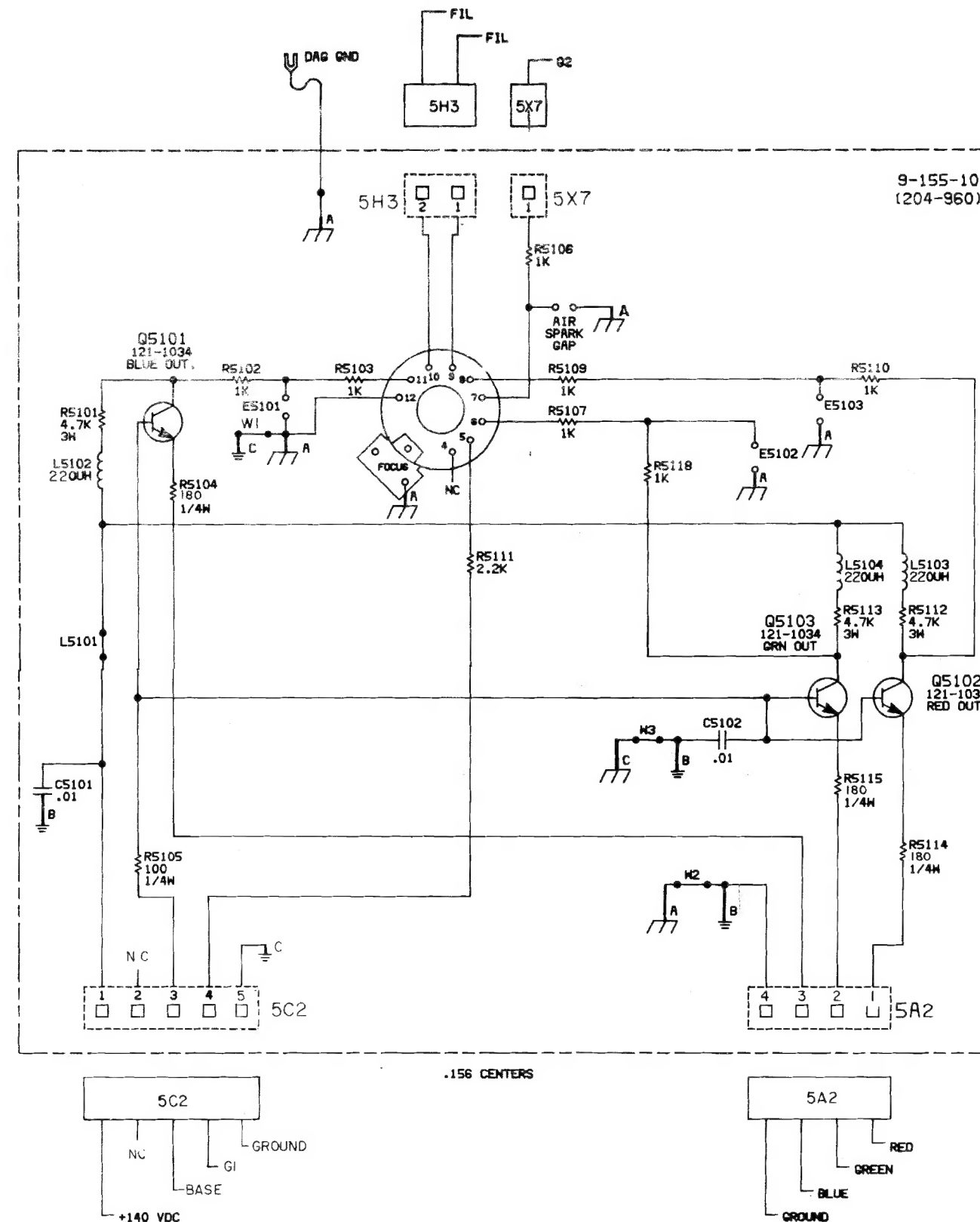
Board					Description
9-227	-01	Ref. No.	Part No.		
RESISTORS (Continued)					
X	X	R3222	63-10235-40	47 Ohm, ±5%, 1/4W Film	
X	X	R3231	63-9982	1 Ohm, ±10%, 2W Wirewound	
X	X	R3233	63-10565-14	3.9 Ohm, ±5%, 1/2W Film	
X	X	R3234	63-10565-14	3.9 Ohm, ±5%, 1/2W Film	
X	X	R3239	63-10244-20	100K Ohm, ±5%, 1/2W Film	
X	X	R3241	63-8246	4 Ohm, 10W Wirewound	
X	X	R3244	63-10840-40	47 Ohm, ±5%, 3W Film, Tin Oxide	
X	X	R3245	63-10710A	Thermistor	
X	X	RX3246	63-10657-03	1.2 Meg Ohm, ±20%, 1/2W Carbon	
	X	R3260	63-10243-96	10K Ohm, ±5%, 1/2W Film	
	X	R3261	63-10244-24	150K Ohm, ±5%, 1/4W Film	
	X	R3262	63-10235-68	680 Ohm, ±5%, 1/4W Film	
X	X	R3401	63-10236-46	1.2 Meg Ohm, ±5%, 1/4W Film	
X	X	R3402	63-10236-22	120K Ohm, ±5%, 1/4W Film	
X	X	R3403	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	
X	X	R3404	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	
X	X	R3405	63-10236-08	33K Ohm, ±5%, 1/4W Film	
X	X	R3406	63-10235-68	680 Ohm, ±5%, 1/4W Film	
X	X	R3407	63-10236-18	82K Ohm, ±5%, 1/4W Film	
X	X	R3408	63-10236-04	22K Ohm, ±5%, 1/4W Film	
X	X	R3409	63-10857-17	100K Ohm, Control-Rotary Single-Green	
X	X	R3410	63-10236-31	300K Ohm, ±5%, 1/4W Film	
X	X	R3411	63-10236-03	20K Ohm, ±5%, 1/4W Film	
X	X	R3412	63-10236-13	51K Ohm, ±5%, 1/4W Film	
X	X	R3413	63-10236-07	30K Ohm, ±5%, 1/4W Film	
X	X	R3414	63-10235-98	12K Ohm, ±5%, 1/4W Film	
X	X	R3415	63-10236-02	18K Ohm, ±5%, 1/4W Film	
X	X	R3417	63-10243-60	330 Ohm, ±5%, 1/2W Film	
X	X	R3418	63-10857-08	2K Ohm, Control-Rotary Single-Yellow	
X	X	R3419	63-10235-84	3.3K Ohm, ±5%, 1/4W Film	
X	X	R3420	63-10236-10	39K Ohm, ±5%, 1/4W Film	
X	X	R3421	63-10235-73	1.1K Ohm, ±5%, 1/4W Film	
X	X	R3422	63-10243-60	330 Ohm, ±5%, 1/2W Film	
X	X	R3423	63-10243-60	330 Ohm, ±5%, 1/2W Film	
X	X	R3424	63-10235-72	1K Ohm, ±5%, 1/4W Film	
X	X	R3425	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	
X	X	R3428	63-10235-82	2.7K Ohm, ±5%, 1/4W Film	
X	X	R3429	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	
X	X	R3431	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
X	X	R3432	63-10235-55	200 Ohm, ±5%, 1/4W Film	
	X	R3432	63-10235-79	2K Ohm, ±5%, 1/4W Film	
X	X	R3433	63-10236-20	100K Ohm, ±5%, 1/4W Film	
X	X	R3434	63-10236-22	120K Ohm, ±5%, 1/4W Film	
X	X	R3435	63-10235-63	430 Ohm, ±5%, 1/4W Film	
X	X	R3436	63-10235-72	1K Ohm, ±5%, 1/4W Film	
X	X	R3439	63-10243-79	2K Ohm, ±5%, 1/2W Film	
X	X	R3440	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	
X		R3441	63-10857	100 Ohm, Control-Rotary Single-Horizontal Center	
	X	R3441	63-10857-02	250 Ohm, Control-Rotary Single-Horizontal Center	
X	X	R3442	63-10235-86	3.9K Ohm, ±5%, 1/4W Film	
X		R3443	63-10235-65	510 Ohm, ±5%, 1/4W Film	
	X	R3443	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
X	X	R3444	63-10235-60	330 Ohm, ±5%, 1/4W Film	
X	X	R3445	63-10235-80	2.2K Ohm, ±5%, 1/4W Film	
	X	R3446	63-10235-72	1K Ohm, ±5%, 1/4W Film	
X		R3449	63-10235-76	1.5K Ohm, ±5%, 1/4W Film	
X		R3451	63-10235-82	2.7K Ohm, ±5%, 1/4W Film	
	X	R3451	63-10235-88	4.7K Ohm, ±5%, 1/4W Film	
X	X	R3452	63-10235-92	6.8K Ohm, ±5%, 1/4W Film	
	X	R3453	63-10235-75	1.3K Ohm, ±5%, 1/4W Film	
X	X	R3461	63-10236	15K Ohm, ±5%, 1/4W Film	
X	X	R3462	63-10236-13	51K Ohm, ±5%, 1/4W Film	

ZENITH MONITOR — CRT SOCKET BOARD
REPLACEMENT PARTS LIST

MAIN BOARD (Continued)

Ref. No.	Part No.	Description
SEMICONDUCTORS		
CR2104	103-142-01	Diode, Low Voltage
CR2105	103-254-01	Diode, Low Voltage
CR2106	103-254-01	Diode, Low Voltage
CR2107	103-254-01	Diode, Low Voltage
CR2501	103-142-01	Diode, Low Voltage
CR2502	103-142-01	Diode, Low Voltage
CR2503	103-142-01	Diode, Low Voltage
CR3202	103-330A	Diode, Low Voltage
CR3205	103-309-01	Diode, Zener 10V 1W
CR3206	103-254-01	Diode, Low Voltage
CR3208	103-326A	Diode, Low Voltage
CR3210	103-254-01	Diode, Low Voltage
CR3211	103-254-01	Diode, Low Voltage
CR3214	103-284-A	Diode, Low Voltage
CR3217	103-326A	Diode, Low Voltage
CR3219	103-330A	Diode, Low Voltage
CR3223	103-330A	Diode, Low Voltage
CR3224	103-330A	Diode, Low Voltage
CR3231	103-315-06A	Diode
CR3232	103-315-06A	Diode
CR3233	103-315-06A	Diode
CR3234	103-315-06A	Diode
CR3235	103-284A	Diode, Low Voltage
CR3401	103-142-01	Diode, Low Voltage
CR3404	103-143-01	Diode, Low Voltage
CR3405	103-142-01	Diode, Low Voltage
CR3406	103-142-01	Diode, Low Voltage
CR3408	103-279-14	Diode, Zener 6.8V 1/2W
Q2101	F-10896	Transistor & Heat Sink Assy.
Q2102	F-10896	Transistor & Heat Sink Assy.
Q2103	121-975	Transistor NPN
Q2104	121-1064	Transistor PNP
Q2501	121-1019	Transistor PNP
Q2502	121-895	Transistor NPN
Q2502	121-551	Transistor NPN
(on -01 version)		
Q2503	121-1019	Transistor PNP
Q2504	121-895	Transistor NPN
Q2504	121-551	Transistor NPN
(on -01 version)		
Q2505	121-1019	Transistor PNP
Q2506	121-895	Transistor NPN
Q2506	121-551	Transistor NPN
(on -01 version)		
Q2507	121-1019	Transistor
Q2508	121-1019	Transistor
Q2509	121-1019	Transistor
Q3200	F-12737	Transistor & Heat Sink Assy.
Q3201	121-499-01	Transistor NPN Regular Feed Back
Q3202	121-1034	Transistor NPN
Q3203	121-1059	Transistor PNP
Q3401	121-895	Transistor NPN
Q3402	121-986	Transistor PNP
Q3403	121-985	Transistor NPN
Q3404	121-895	Transistor NPN
Q3405	121-895	Transistor NPN
TRANSFORMERS & COILS		
L2502	20-3887-01	Coil Peaking 1.2 UH
L2503	20-3887-01	Coil Peaking 1.2 UH
L2504	20-3887-01	Coil Peaking 1.2 UH
L3201	20-2021	Coil Peaking 100 UH
LX3202	95-3501-01	Transformer Choke 60 UH
L3401	20-3831	Coil Peaking 663 UH
L3402	20-3998	Coil Peaking 39 UH
L3402	20-4026	Coil Turnable 39 UH
(on -01 version)		

CRT SOCKET (9-155-10)		
Ref. No.	Part No.	Description
CAPACITORS		
C5101	22-4671	0.01 MF, 1.5KV, +80%—20% Disc
C5102	22-3512	0.01 MF, 1KV, +40%—10% Disc
TRANSFORMERS & COILS		
L5102	20-3887-28E	220 MH Peaking
L5103	20-3887-28E	220 MH Peaking
L5104	20-3887-28E	220 MH Peaking
SEMICONDUCTORS		
Q5101	F7510	Transistor, NPN, Video Out, Blue
Q5102	F7510	Transistor, NPN, Video Out, Red
Q5103	F7510	Transistor, NPN, Video Out, Green
RESISTORS		
R5101	63-10840-88	4.7K Ohm, ±5%, 3W Film
R5102	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5103	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5104	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5105	63-10235-48	100 Ohm, ±5%, 1/4W Film
R5106	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5107	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5108	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5109	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5110	63-7785	1K Ohm, ±10%, 1/2W Carbon
R5111	63-7799	2.2K Ohm, ±10%, 1/2W Carbon
R5112	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5113	63-10840-88	4.7K Ohm, ±5%, 3W Carbon
R5114	63-10235-54	180 Ohm, ±5%, 1/4W Film
R5115	63-10235-54	180 Ohm, ±5%, 1/4W Film
MISCELLANEOUS		
5A2	86-799	Stake Connector 4/.156
5C2	86-799	Stake Connector 4/.156
5H3	86-799	Stake Connector 2/.156
5X7	86-799	Stake Connector 1/.312
	A-10008	CRT Socket



NOTE:
1. ALL RESISTORS ARE 1/2WATT UNLESS OTHERWISE SPECIFIED.

NOTES: (USED WITH CIRCUIT REFERENCE DESIGNATORS)
A. P/L = SEE PARTS LIST FOR APPLICABLE USAGE.
B. —●—●— = JUMPER WIRE USED INSTEAD.
C. —■—■— = PROVISION ON PRINTED CIRCUIT BOARD.

⏏
DAG
GROUND

⏏
SIGNAL
GROUND

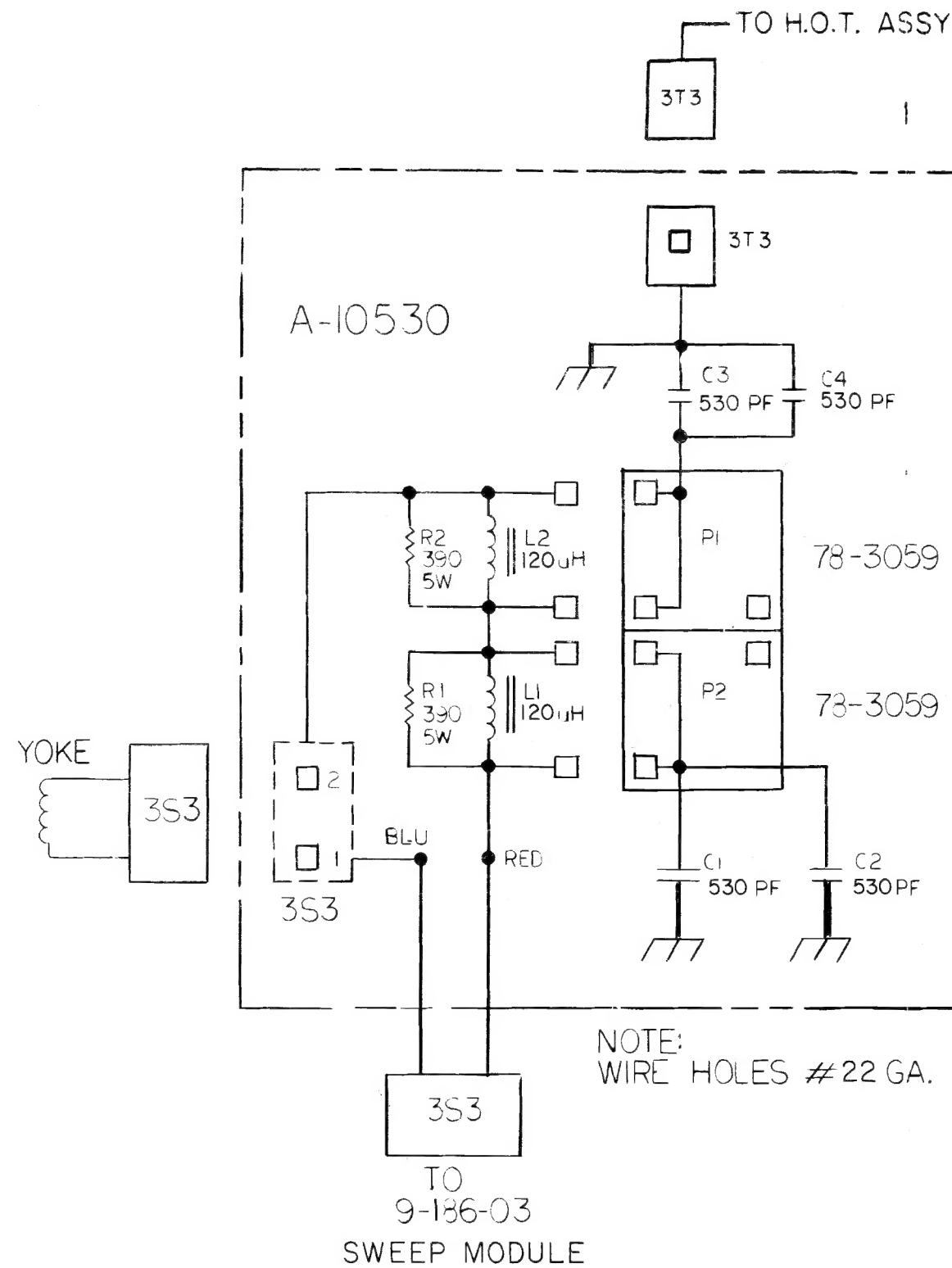
M051-00087-A022

SCHEMATIC FOR
9-155-10
RGB COLOR MONITOR
CRT SOCKET BOARD

ZENITH
RADIO CORP.
CHICAGO, ILL.

ISSUE

9-155



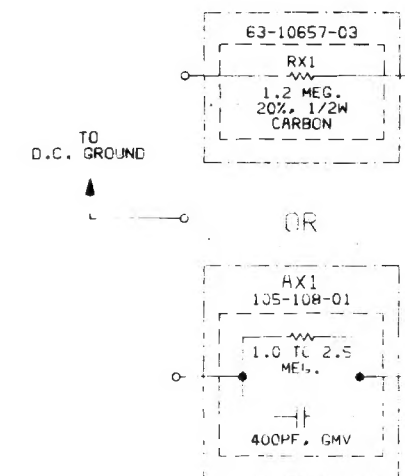
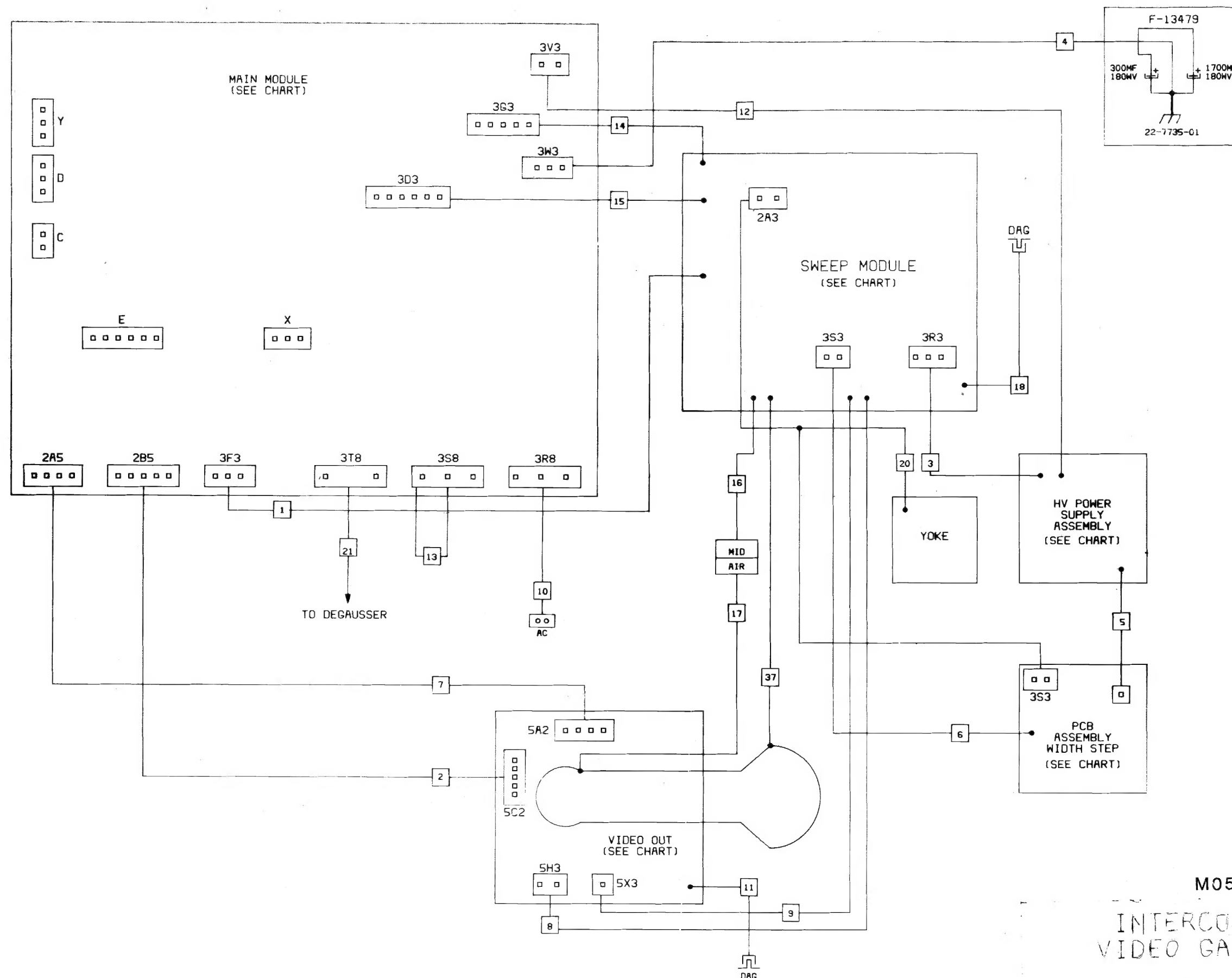
M051-00087-A023

SCHEMATIC
FOR A-10530
WIDTH STEP ASSY.

ZENITH
RADIO CORP.
CHICAGO, ILL.

ISSUE
B

A-10530



IMPORTANT SAFETY NOTICE

WHEN SERVICING THIS CHASSIS, UNDER NO CIRCUMSTANCES SHOULD THE ORIGINAL DESIGN BE MODIFIED OR ALTERED WITHOUT PERMISSION FROM THE ZENITH RADIO CORPORATION. ALL COMPONENTS SHOULD BE REPLACED ONLY WITH TYPES IDENTICAL TO THOSE IN THE ORIGINAL CIRCUIT, AND THEIR PHYSICAL LOCATION, WIRING AND LEAD DRESS MUST CONFORM TO ORIGINAL LAYOUT UPON COMPLETION OF REPAIRS.

SPECIAL CIRCUITS ARE ALSO USED TO PREVENT SHOCK AND FIRE HAZARD. THESE AREAS ARE SHADED ON THE SCHEMATIC FOR EASY IDENTIFICATION. THE LETTER "X" INCLUDED IN THE ITEM NUMBER DESIGNATES SPECIAL FAULTSAFE COMPONENTS IN THESE AREAS WHICH ARE REQUIRED TO MAINTAIN SAFE PERFORMANCE. NO DEVIATIONS ARE ALLOWED WITHOUT PRIOR APPROVAL BY THE PRODUCT SAFETY ENGINEERING DEPARTMENT.

THIS CIRCUIT DIAGRAM MAY OCCASIONALLY DIFFER FROM THE ACTUAL CIRCUIT USED. THIS WAY, IMPLEMENTATION OF THE LATEST SAFETY AND PERFORMANCE IMPROVEMENT CHANGES INTO THE SET IS NOT DELAYED UNTIL THE NEW SERVICE LITERATURE IS PRINTED.

M051-00087-A025

INTERCONNECT FOR
VIDEO GAME MONITOR

ZENITH
RADIO CORP.
CHICAGO, ILL.

ISSUE